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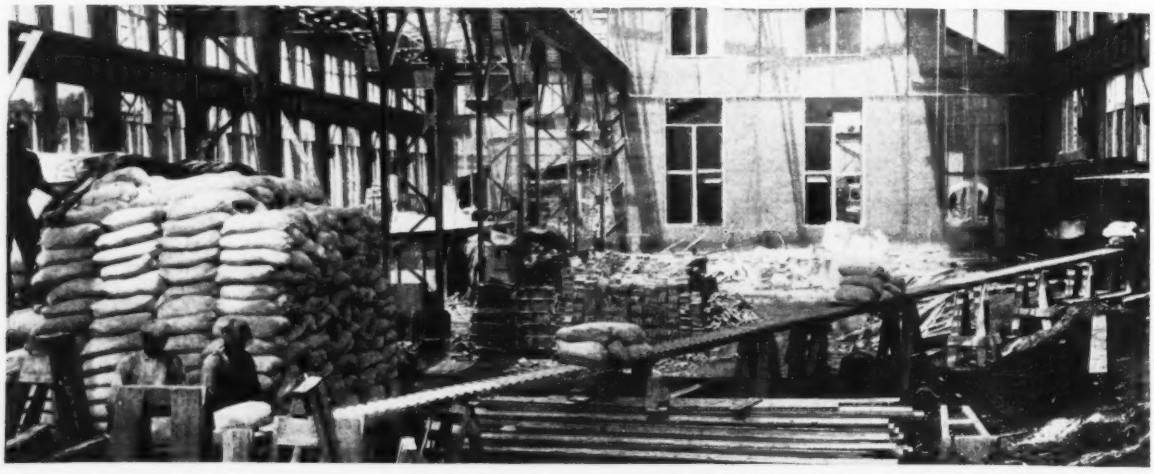

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. MEHREN *Editor*

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Partisan War Exploitation

In language more vigorous than polite Charles G. Dawes, the Chicago banker who as a brigadier general was the chief purchasing agent of the A. E. F., last week told a committee of the House of Representatives some plain truths that the whole body of politicians would do well to heed. The people of the United States are sick of the partisan exploitation of the war and the depreciation of the war-making activities. Honest criticism cannot be flouted, but criticism that is intended merely for political purposes, and which is based entirely on the principle that what we know now we should have known in 1917 and 1918, is beneath respect. Too much of it has been heard in and around the halls of Congress from the mouths of the now victorious Republicans. That one of the leading men in the ranks of that party, and one who has been prominently mentioned for high position within its gift, should so denounce the methods of the purely political wing is significant and deserving of commendation.

Cities and the Unemployed

AS PART of the problem of the times there is now considerable talk of armies of unemployed in our cities and the duty of city governments to find them employment. In considering such proposals it should be remembered that "relief work" is notoriously inefficient, and that if provided the kind should be chosen and methods of control employed that are well designed to reduce this inefficiency to the lowest possible level. The reaction of "relief work" upon the already low efficiency of regular city employees, as well as upon their wages and on the great mass of taxpayers, many of whom may also be suffering from the combination of circumstances that throws large numbers out of work, should also be considered. Fortunately there seems no reason to expect that much justifiable "relief work" will be needed. A considerable amount of labor would be quickly absorbed through regular channels if it were offered at rates well below the present high figures but still well above starvation or even minimum living wages.

Conferences

EITHER as a barrier against the unwelcome caller or as an excuse for a prolonged luncheon, the "conference" is the greatest modern boon to business men. In the old days they used to talk things over once in awhile; today they go into "conference" at every opportunity. The world progresses. But this valuable business tool is being extended into the solution of public questions. Would you lessen the housing difficulty or reduce the income tax? Call a conference at some place where the hotels are elaborate and expensive. Invite to speak half a dozen congressmen, an officer, preferably the president, of the American Federation of Labor, the vice-president of a trust company (never forget the trust company man) the head of the certified accountants' association and the collector of internal revenue. Listen to them discourse at intervals through three days with a banquet, a round-table luncheon and a reception in between, and embalm the cream of their platitudes in some unanimously adopted resolutions. Then go home, forget about housing and get to work on your next year's income tax statement on the old basis of reckoning and prepare the program for the next group of annual conferences. Repeat ad lib. Some day some one will achieve fame by organizing a conference for the abolition of "conferences."

Ethics for the Contractor

TO THE engineer who, in the construction industry, has arrogated to himself the only professional status, it will come as a shock or as a cause for incredulous smiles to hear of the contractors discussing a code of ethics. Yet they are discussing one; they are doing it seriously and honestly, and not as a camouflage measure. They go so far as to put contracting into a professional class. They conceive of themselves as service organizations accepting obligations toward a client.

This attitude, too, has a solid foundation. They are not manufacturers merely putting before a prospective purchaser a finished product which he can examine and test, and determine, with the article in hand, whether it is worth the demanded price. No, they are manufacturers employed, or as their own language would have it, "retained," to produce in the future a certain structure. Documents attempt to tell what that structure is to be; many precautions are taken to assure delivery of an article conforming to the documentary descriptions, but despite documents and drawings and contract articles what the purchaser ultimately gets depends in large measure upon factors not definable, upon the "skill, integrity, and responsibility" of the contractor. Is it far fetched, then, to consider that the contractor has accepted a responsibility akin to the professional? We think not.

General appreciation by contractors of the character of that responsibility and serious acceptance generally of a professional code are not soon to be expected. There will be many lapses. There must be much educational work. But the attitude of engineers toward the contractors' new endeavors must be that of encouragement. It will be easy to poke fun and to cite the rascal who was caught skimping cement in the last sewer job. Such an attitude never helped anyone to higher levels.

The contractors, it is true, must prove the sincerity of their endeavors, but the number of sterling contractors who are putting their shoulder to the wheel to realize these aims warrants the faith and confidence, and the assistance, of the engineering profession.

Railroad Costs and Rates

ONLY COSTS of railroad operation that cannot be reduced will be accepted as the basis of justification for railroad rates, according to President Beatty of the Canadian Pacific Ry. in his address at the recent annual meeting of the Engineering Institute of Canada. President Beatty believes that real prosperity is that obtained by free traffic movement under moderate rates. Here certainly is a frank and liberal view of the difficult situation through which both this country and Canada are passing. Our experience has shown that rates must be made to yield a fair return above operating expenses and fixed charges in order to insure adequate development of transportation facilities through the stabilization of railroad credit. Canada at present is overbuilt with railroads; the United States is underbuilt. In Canada a cry went up immediately against the recent material increase in rates; in the United States there was but faint objection. But in spite of our need for expanding railroad facilities the carriers themselves do not look with favor upon further increases in rates, but rather toward a reduction in operating expenses. It appears that the first step is being made in current hearings before the Railway Labor Board. But will this be going far enough? Ten years have passed since Justice Brandeis, on the authority of Harrington Emerson, made the charge that the railroads of the country were wasting $1,000,000 a day. Then there was much protest from the railroads; now they are more ready to concede that there are large preventable wastes. Whatever they are they must be sought out and eliminated. The day when railroad presidents can rest easy in the assurance of steady net earnings is still very, very far away.

Immediate Relief for New York

DETAILS of the "measures for immediate" relief at the Port of New York were not given in the summary report of the New York-New Jersey Port and Harbor Development Commission, commented upon in these columns last week. As "measures for immediate relief" the commission proposes (a) consolidation of marine equipment and service, and (b) inauguration of voluntary store-door delivery by an organized motor-truck medium, and "urges that they be adopted at once." These columns have previously urged full consideration for a test in New York, necessarily in modified form, of the successfully established system of operation in Cincinnati employing motor trucks with demountable bodies for the interchange of less than carload freight between railroad main and sub stations. Thus almost all of the Manhattan railroad pier stations would be released to ocean shipping, as well as a good part of the New Jersey water front. But while urging efficiently co-ordinated trucking distribution as a measure for immediate relief—so far without detailed recommendations—the commission assents to the ultimate abandonment of the Hudson River ferry routes. Motor-truck distribution from New Jersey would depend directly on the ferry routes. Regardless of future tunnel construction, the fanlike distribution furnished by these ferries is a powerful argument against their abolishment to say nothing of resulting inconvenience to commuters. True, the commission's ultimate plan would not require the ferry routes for movement of railroad freight. Partial construction immediately of the proposed Manhattan freight terminals might well provide a means for reconsolidating less than truckload consignments. Without such zone distributing points it is estimated that only some 30 per cent of freight in and out of Manhattan is available for direct, 5-ton-truckload run between rail transfer and store door. Whatever the advantages of the commission's ambitious engineering plan, at best the relief promised is remote since negotiations and construction will necessarily consume years. An ultimate solution is, of course, necessary, but there is also needed now immediate relief and immediate action through evolutionary methods that will bring quick results with small capital outlay.

The Engineer's Relation to Contract Risks

MR. KING in his paper before the Associated General Contractors at New Orleans (see last issue, page 227) put much emphasis on indefinite specifications and the arbitrary power of the engineer as two major risks of contracting which should be reduced. Fair-minded engineers will readily agree with him that there is far too much of vague specification writing, but they will not so quickly nor fully acquiesce in his condemnation of the degree of power vested in the engineer.

Though it could well be discussed in elaborate detail, and certain limitations enlarged upon, the general thesis that specifications should be more definite is sound. Of course, there is much variation in specifications. Some engineers have a well-deserved reputation for the clarity, preciseness and fullness with which they explain what the contractor is to do. But where one deserves commendation there are five that merit adverse criticism. Obviously definition to the last degree is often difficult, and in many cases quite impossible, as when quality of workmanship is involved, but the ground for improvement on clearly definable features is very great. The contractors are right, then, in insisting that indefinite specifications are a risk of contracting that could be greatly reduced.

On theory Mr. King's second contention, for restriction of the engineer's power, is justified. The engineer should be an impartial judge, not a partisan wielder of arbitrary power. However, the authority given him under the general conditions of contracts has resulted from the experience of engineers—and lawyers—with contractors. They have found so many incompetent and dishonest contractors that they have felt it necessary to insert these clauses for the protection of their client's interests.

Despite the reason for this state of affairs, the ultimate interests of all purchasers of construction demand a wider use of arbitration provisions in contracts. But both parties have obligations; the engineers need to unbend to a certain extent, while organized contracting must raise the standards of its members.

Obviously the existing evils chase themselves around in circles. The indefinite specification causes loss to the contractor; the contractor endeavors to recoup himself by skimping; the engineer tries to prevent skimping by contract conditions that give him unlimited powers; these unlimited powers, as Mr. King truly says, encourage vagueness in specification writing. Thus we find ourselves back to where we began. The improvement can start at *any* point in this vicious circle; preferably it should start at *every* point simultaneously. In

the end, not merely will the contractor benefit, but also the owner, who, after all, is the most important factor in the whole process, for it is he that employs both engineer and contractor.

California's Highways

IN THIS issue is an extract from the report of the California Highway Commission which, though not so written, may be regarded as a partial reply to the criticisms of the California automobile clubs, summarized in the last issue of *Engineering News-Record*, page 207. Broadly there are two phases of the situation which warrant comment. The first relates to the fundamental character of the disagreement between the investigators and the commission; the second to the characteristics to be expected—and actually found—in a report coming from non-highway specialists.

The first phase is easily recognized by those familiar with highway work. It is merely a local manifestation of the old contest between those who want only the highest type of construction and those who favor a lower type in order that all parts of the community may get an acceptable highway service as soon as possible. The attitudes can be illustrated by the familiar example of the back-platform critic who can easily show the railroad engineer how a lot of the curves could have been eliminated, but who in his planning forgets the financial limits imposed on the engineer by a tight-fisted board of directors. Coming from the outside it is easy to set up ideals for high-class construction; it is quite different to take a state lacking an adequate system and so distribute the funds that the *best interests of the entire community* (an aim itself susceptible of widely varying definition) will be served.

There are, of course, two extremes. On the one hand would be an extremely limited highway system, but all of the highest type; on the other, a system in which the type was selected merely to be cheap enough to build into every portion of the state. Neither of the extremes is sound; nor do the investigators argue for the first, nor the commission for the second. Both recognize that between the extremes lies the correct solution; but that middle ground is very broad, and the investigators tend to go to one edge of it, the commission to the other. Either may be sound when subjected to economic tests. Neither of the brief reports available, however, gives a disinterested party sufficient data to come to a safe judgment. It is easy, though, to point out the essential identity of the controversy with that which is always found in highway circles.

The other feature referred to—the value of the non-highway engineer's opinion—is strongly emphasized in the summary of the investgators' report. They cut right through to the core of present deficiencies in our highway thinking. They are unhampered by tradition. At the same time they lack that sympathy which comes from knowing how and why these conditions have developed.

For example, they properly decry the lack of experimentation and research. They criticise the failure to enforce traffic laws. In both they are right, and the new emphasis they place on these and other shortcomings will be a benefit to highway constructors.

On the other hand they give no evidence, in their summary at least, that they appreciate how impossible it has been either to squeeze out of lay commissioners funds for research, or, in the terrific rush of recent highway expansion, to spare the men and time for the efficient organization of research work. The same factors have hampered the enforcement of traffic laws.

Moreover, these conditions obtain throughout the country. If the California engineers are to be damned on these grounds all highway engineers will go down in the same condemnation.

While specifically reporting on California's highways, the automobile clubs' investigators will help to awaken all highway engineers to the importance of certain neglected phases of their work. In so doing the investigators join their influence with that of other agencies, notably on research work, with Mr. McDonald, of the Bureau of Public Roads, and with the highway advisory board of the National Research Council. All such prodding is good, for the tremendous prospective expenditure in public roads warrants a great deal of experimentation and strong measures to conserve the roads once they are built.

Mr. Hirst's Resignation

A STRONG indictment of our narrow policies in the building of our highway organizations is brought against the public in the letter which A. R. Hirst has addressed to the people of Wisconsin in connection with the submission of his resignation as state highway engineer. He recognizes the serious responsibility of his great office, he realizes that the public's policy will not permit of its proper discharge, and he courageously abandons that which he had looked forward to as a life work—the building for the people of Wisconsin of an adequate highway system. He plays the part through in the spirit in which he has ser ed the state, for he subordinates any personal interest he might have in an early relief from his duties by giving the authorities until the end of this year, if need be, to choose his successor.

The cause of his resignation is the impossibility of maintaining, under the pernicious policy of the public, an organization competent to secure the efficient expenditure of highway funds. Inadequate compensation and uncertain tenure of office make public service merely stepping stones to better positions with private agencies.

Unfortunately, taking the country as a whole, these conditions will long persist. In the New England States, with several hundred years of governmental organization, there has been time to develop a certain measure of maturity. There, more than elsewhere, the public official has an established status, and length and effectiveness of service are held in esteem. Even there the compensation is not what it ought to be.

In Wisconsin, Mr. Hirst's words should have a good effect. Let us hope that his warning will be the beginning of a broader policy in that state.

But the message should be considered as addressed to the country as a whole. It is ammunition and encouragement for such organizations as the former committee on compensation and classification of Engineering Council and the American Association of Engineers. But it should equally be material upon which such agencies as the American Society of Civil Engineers and the Associated General Contractors should work. They, like the first named bodies, have obligations to the public which, of course, they fully recognize. Obligations, though, must be translated into action— educational, if not otherwise—if there are to be results.

Snow Surveying for the Forecasting of Stream Flow

Methods, Factors and Results in Making Spring Predictions of Summer Water Supply for Irrigation and Power in Streams Fed by Mountain Snows

By J. E. Church, Jr.
Nevada Co-operative Snow Surveys, Reno, Nev.

Part I—Relative Value of Different Methods—Variable Factors Affecting Run-Off

AN INCREASING interest shown by engineers in the problem of forecasting water supplies from winter snows has led to the preparation of two articles representative of the main phases of this problem, as follows: (1) The relative value of snow surveying as compared with other methods; (2) the effect of weather upon run-off; (3) forecasting supply from large areas; (4) methods of inaugurating a snow survey. Earlier articles on this subject include the following: "Snow Surveys for Predicting Steam Flows," *Engineering News*, May 29, 1913, p. 110; "Snow Survey for Forecast of Watershed's Yield," *Engineering Record*, April 17, 1915, p. 494; "Determination of Water Supply from Snow Fields," *Engineering News-Record*, Oct. 23, 1919, p. 766; "California-Nevada Co-operative Snow Survey," Jan. 8, 1920, p. 109; "Snow and Water Relations in Nevada," Sept. 9, 1920, p. 492. A view of the Mount Rose Observatory near Reno, Nev., at an altitude of 10,800 ft., is given in Fig. 1.

SNOW SURVEYS

Snow surveying is a special phase of hydraulic engineering developed for regions where mountain snows are the source of streams and rivers and where it is highly important to determine the water content and conditions of the snow fields in order to predict or forecast annually the summer flow that will be available for power, irrigation and other purposes. Snow survey methods have been developed most extensively by the States of Nevada and California, and in Switzerland in the study of glacier movements.

In view of the increasing importance and interest of this work, a comprehensive article on snow surveying with reference to the forecasting of stream flow has been prepared for *Engineering News-Record* by Prof. J. E. Church, Jr., of the University of Nevada, who with Major P. M. Norboe, chief assistant State engineer of California, and H. F. Alpas, meteorologist of the U. S. Weather Bureau, is in charge of the Nevada-California co-operative snow surveys, and who has charge also of the Mount Rose meteorological observatory, which was established partly for this purpose near Reno, Nev.—*Editor.*

TABLE I. SIMILARITY OF SNOW COVER IN TAHOE BASIN AS DETERMINED BY PERCENTAGE METHOD AND RISE OF LAKE TAHOE AFTER APRIL 1, IN YEARS OF APPROXIMATELY NORMAL PRECIPITATION DURING RUN-OFF (PER CENT OF NORMAL)

	1910–11	1911–12	1912–13	1913–14	1914–15	1916–17
Snow cover (average of six courses)	170 4	49 7	58 2	153 8	88 2	115 6
Actual rise of lake after April 1	172 3	64 5	69 3	150 6	89 8	125 9
Variation between methods	—1 9	—14 8	—11 1	+ 3 2	— 1 6	—10 3

Snow surveying comprehends the determination of the water content of the snow cover by means of sampling apparatus, being unlike the measurement of snowfall by means of catch basins or snow stakes. Two methods have been developed: the percentage method and the method of areas. The former method is simple, being merely the determination of the percentage relationship of the seasonal snow cover of any given basin or region to its normal, with the assumption that such percentage is indicative of the coming seasonal run-off in the streams below. The latter method endeavors to determine the acre-feet of water in the snow fields and the probable net amount that will find its way into the streams.

The difference between the two methods is fundamental. The percentage method is based upon the fact that the "big storms" which furnish the bulk of the winter snow are comparatively uniform in intensity over considerable areas, thus lacking the spotted character of the lighter summer rains. Therefore it is possible to select from four to six snow survey courses distributed over characteristic parts of a basin and, by averaging their individual seasonal percentages, to obtain a close seasonal percentage for the entire basin. The only requirement is that the snow courses should be fixed and fairly long, such as 40 measurements 50 to 100 ft. apart; they must be located at a sufficient altitude to prevent distortion of the measurements by winter melting. A safe altitude in the Sierra Nevada has been found to be approximately 7,000 ft. Sites for snow courses should be selected, where possible, in protected flats or in timber, where the snow cover does not suffer oscillation by the wind. A part of the region included in the Sierra Nevada snow surveys is shown in the photograph, Fig. 2.

The method of areas is beset by two serious difficulties: (1) The large variation in the snow cover (even of individual basins) with elevation and distance from the crest of its watershed; (2) the difficulty of determining the normal seepage and evaporation losses of the region. The close agreement, when the precipitation during the period of run-off is fairly normal, between the snow cover and the run-off as determined by the percentage method is shown by Table I. The apparently wide divergence where the area method is used is shown in Table II.

TABLE II. DIVERGENCE BETWEEN METHOD OF AREAS AND PERCENTAGE METHOD. (RISE OF LAKE TAHOE AFTER APRIL 1)

Season	Estimated Rise: Method of Areas. (Corrected for normal losses by evaporation from snow and surface of lake and by absorption by the soil) Ft.	Per Cent of Normal	Estimated Rise: Percentage method. (No corrections for normal losses necessary) Ft.	Per Cent of Normal	—Actual— Rise Ft.	Per Cent of Normal	Divergence Between Estimated and actual Rise per Cent of Normal Rise: Method of Areas	Percentage Method
1914–15	0.08	5.1	1.46	88.2	1.49	89.8	—84.7	—1.6
1915–16	1.73	104.0	2.52	151.9	2.48*	149.4*	—45.4	+2.5

* Corrected by 50 per cent for abnormal deficiency in precipitation during rise (see paragraph on "Factors Affecting Run-Off"). Actual rise only 1.65 ft.

It is unfortunate that the long series of snow surveys conducted under the method of areas in Big Cottonwood Canyon, Utah, since 1911-12 by Salt Lake City, in co-operation with the U. S. Weather Bureau, is confused by the fact that only two-thirds of the watershed is surveyed, the remainder being considered as possessing but little snow. Moreover, no attempt is made to correct the forecast for normal losses by evaporation and absorption by the soil. With possibly one exception, other experiments with this method have gradually been abandoned. Consequently, in the following comparison of methods the percentage method alone will be employed as a standard.

Three methods of forecasting based upon seasonal percentage but not upon snow surveying have entered or may enter into competition with the latter, because of their ease or inexpensiveness. These are the methods of accumulated snowfall, the winter rise of open lakes, and the depth of snow on the ground. The basis for choice between these methods and snow surveying is accuracy modified only by the question of expense.

Accumulated Snowfall—The inherent weakness of this method is the variation in the density of the snow, not only from storm to storm but even from season to season. This is particularly true where the snow stake, only, is employed and the water content of the snow cannot be determined because of distance of station from observer or magnitude of the snowfall. In comparative measurements made in the Tahoe basin by the Mount Rose Observatory and the U. S. Weather Bureau the divergence between this method and snow surveying varied between 20 and 55 per cent for five seasons in a total of eight. Although this method is moderate in cost its excessive latent inaccuracy makes it undesirable.

Winter Rise of Open Lakes—The winter rise of lakes, such as Lake Tahoe, which never freeze, should be apparently a safer standard for measuring the snowfall upon the adjacent watershed than the method of accumulated snowfall, as the snow falling upon the lake is reduced to water. The reverse is true, however, for the advantage of an inelastic standard, such as water is overcome by the variable factors of winter run-off from the watershed into the lake and the evaporation from its surface. In fact, a 9-year record shows that with a single exception the method of accumulated snowfall is from 5 to 40 per cent more accurate.

TABLE III. COMPARISON OF METHODS OF DEPTH OF SNOW ON THE GROUND AND WATER CONTENT. ANNUAL SNOW SURVEY IN TAHOE BASIN, APRIL 1

(Seasonal Percentage)

	Season						
Method	1909–10	1910–11	1911–12	1912–13	1913–14	1914–15	1915–16
Depth of snow	80.0	165.1	59.4	66.5	141.9	93.6	145.5
Water content	82.7	170.4	49.7	58.2	153.8	88.2	151.9
Variation	— 2.7	—5.3	+9.7	+ 8.3	—11.9	+5.4	—6.4

Depth of Snow on the Ground—Of the three methods in competition with snow surveying the depth of snow on the ground at the beginning of the season of run-off is by far the most accurate, and if handled carefully it is a close rival of snow surveying. The prime essentials are that courses equal in fixity and length to those used in snow surveying must be maintained and that the measurements of depth must be made only when the new snow has settled approximately to the density of the snow beneath. Fewer measurements, as at occasional snow stakes, or measurements immediately after a storm, would cause corresponding distortion in the results.

Whatever divergence occurs beyond the distortion due to the above factors is caused by the seasonal density attained during the ripening of the snow. This density will vary with the winter weather, particularly the temperature and the wind, but the maximum variation between seasons is rarely greater than 10 per cent. This is graphically shown in Table III, based upon snow surveys in the Tahoe basin, in which both the depth of snow on the ground and the water content were determined over the same courses. Since the surveys were made without reference to the date of the previous storm the actual variation between the two methods should be less than shown in the table.

The gain over snow surveying is merely in saving the moderate expense for snow samplers. Aside from this the expense for field operations would be identical, without the satisfaction of certainty regarding the data obtained. However, the question of exact cost, which depends upon the area and number of the basins included, will be discussed in the concluding part of the article.

FIG. 1. MOUNT ROSE OBSERVATORY IN THE SIERRA NEVADA; ALTITUDE 10,800 FT.

Factors Affecting Run-Off

Shrinkage and acceleration of run-off beyond normal conditions occur occasionally and are factors which must be taken into account in predicting the run-off or stream flow of an approaching season.

Shrinkage of Estimated Run-Off—In forecasting the summer flow from winter snows the chief problem is the anticipation and prediction of the abnormal shrinkage that infrequently occurs in the seasonal percentage indicated by the April survey. In the eleven annual surveys made since 1909 in the Sierra Nevada this shrinkage has occurred to an extreme degree three times and to a moderate extent twice. The maximum shrinkage has been 50 per cent of normal for lakes and 25 per cent for rivers.

Precipitation During Run-Off—The major factor in the phenomenon of shrinkage of run-off is lack of precipitation during the period of run-off, rather than late snowfall or dryness of the watershed. This is plainly indicated by the divergence between the maximum shrinkage in lakes and in rivers. Lakes are susceptible to variable precipitation in whatever amount, but streams, because of the preponderating land area of their basins, may be from 80 to 90 per cent immune to such influence when the soil is driest. In fact, the disparity between the susceptible water areas of lake and river basins, as in the case of Lake Tahoe

and the Carson River, may be as great as 50 to 1.

Evaporation being the complement of precipitation and intensifying its lack, the theoretical probability of apparently so small a cause as lack of late spring and summer rainfall producing so marked an effect on the run-off becomes more understandable. No other weather factors could have caused the divergence. For the Tahoe basin this precipitation amounts normally to 22.8 per cent of the snow cover. In April, when

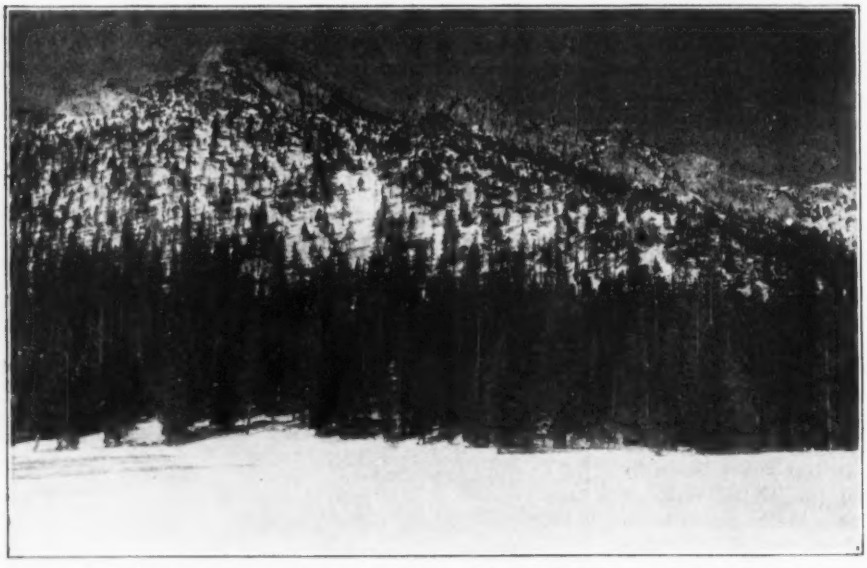


FIG. 2. SNOW SURVEY REGION—HAGAN'S MEADOWS IN THE SIERRA NEVADA

the snow cover is most extensive, it is 10.6 per cent, and in May 9.5 per cent additional.

Despite this fact an effectiveness of 25 per cent seems at first anomalous in face of the further fact that occasional summer precipitation in the semi-arid West is almost negligible as compared with a field of snow, because of the small proportion of the former that finds its way into the streams. However, at the time when the spring precipitation is heaviest the snow cover is most extensive, coming at times almost as low down as the gaging station, so that whatever precipitation falls at this period finds lodgment upon the snow surface and obtains a relatively untaxed passage to the streams.

TABLE IV. RATIO OF DECREASE IN RUN-OFF WITH DECREASE IN SEASONAL PERCENTAGE OF THE SNOW: TAHOE BASIN

Snow Cover — Per Cent	Snow Cover — In.	Absorption, In.	Run-Off — In.	Run-Off — Per Cent of Normal	Ratio of Decrease. Per Cent of Normal Run-Off
100(normal)	22 7	8 6	14 1	100	0
75	8 6	8 6	8 4	59 5	—15 5
50	11 4	8 6	2 8	19 9	—30 1
25	5 7	8 6	—2 9	—20 5	—45 5

The relation of this fact to the April snow survey may be stated as follows: The equality between the seasonal percentage of the snow field, as measured April 1, and the succeeding run-off of April-July is dependent upon the normality of all factors that influence the run-off, for the very normal upon which the seasonal percentage is based is merely the average of many seasons, and presumably so many that any abnormality of the weather has faded into the general average.

Minor Factors in Reduced Run-Off—Lack of autumn rains, snowfall less than normal, and shrinkage in run-off below diversion points are contributory but minor factors in the phenomenon of occasional shrinkage of run-off. The absence of autumn rains in the semi-arid West seems to have little or no effect upon the amount of moisture necessary to prime the soil in the spring, and its effect even upon the winter run-off is not plainly discernible in the presence of other factors. Indeed, the effect of the heaviest snow covers in the Tahoe basin, which have a cumulative effect far in excess of rain, does not persist beyond October, or four months beyond its peak. This is due to the steep mountain slopes and a surface material sufficiently porous to permit a rapid run-off. Meadows and other retarding media are small in area as compared with the entire watershed, so that even the heavier rains are drained off before the time of melting has arrived. Conversely, the freezing of the surface soil, so effective on priming in the East, is entirely lacking, for the surface has been drained dry before the freezing temperatures of winter occur.

The effect of subnormal snowfall in shrinking the computed seasonal percentage of run-off may be clouded by excess or deficiency of precipitation during run-off, but it can be determined mathematically if the initial factors are known. Since the amount of moisture necessary to prime mountain soil in semi-arid regions is practically unaffected by

TABLE V. EFFECT OF WEATHER UPON SEASONAL RUN-OFF

(1) Seasons of Abnormal Shrinkage in Run-Off (per Cent of Normal)

Year	Water Content of Snow Cover	Priming of soil as shown by excess and deficiency of autumn rains and winter run-off: Autumn Rains	Priming of soil as shown by excess and deficiency of autumn rains and winter run-off: Winter Run-Off	Excess and deficiency of precipitation and evaporation: Precipitation	Excess and deficiency of precipitation and evaporation: Evaporation	Run-Off: Seasonal Percentage	Run-Off: Variation Between Snow Cover and Run-Off
A. Carson River Basin							
1909-10	82 7[1]	+165 41	+38 31	—29 2	.....	64 14	—18 6
1915-16	151 9[1]	—69 55	+49 59	—70 4	.....	125 71	—26 2
1917-18	95 4	—25 19	—29 51	—57 2	+27 7[2]	61 31[3]	—35 1[3]
1918-19	96 8	+100 0	—44 52	— 0 8	+36 2[2]	66 58	—30 2
B. Tahoe Lake Basin							
1909-10	82 7[1]	+140 18	+38 31[4]	—85 9	.....	61 45	—21 2
1915-16	151 9	— 42 83	+49 59[4]	—82 9	.....	99 40	—52 5
1917-18	95 0	— 71 96	—29 51[4]	—63 0	+27 7	53 61	—41 4
1918-19	103 0	+113 69	—44 52[4]	—63 5	+36 2	72 89[5]	—30 16

(2) Seasons Without Abnormal Shrinkage in Run-Off (per Cent Normal)

A. Carson River Basin							
1910-11	170 4[1]	—18 80	+ 7 36	+26 8	.....	176 70	+ 6 3
1911-12	49 7[1]	—40 98	—40 75	+51 0	.....	42 43	— 7 4
1912-13	58 2[1]	+22 18	—57 30	+72 4	.....	57 18	— 1 0
1913-14	153 8[1]	—16 92	+81 89	+ 3 5	.....	162 95	+ 9 2
1914-15	88 2[1]	—48 50	—17 35	— 0 4	.....	93 33	+ 5 1
1916-17	115 6[1]	+30 08	+19 08	+ 0 4	+ 6 0[2]	128 65	+13 1
B. Tahoe Lake Basin							
1910-11	170 4	—12 80	+ 7 36[4]	+ 3 27	.....	172 29	+ 1 9
1911-12	49 7	—60 26	—40 75[4]	+63 48	.....	64 46	+14 8
1912-13	58 2	+27 15	—57 30[4]	+12 59	.....	69 28	+11 1
1913-14	153 8	— 6 8	+81 89[4]	— 4 53	.....	150 60	— 3 2
1914-15	88 2	—56 73	—17 35[4]	+11 84	.....	89 76	+ 1 6
1916-17	115 6	—13 02	+19 08[4]	—23 43	+ 6 0[2]	125 90	+10 3

[1] Substituted from Tahoe Basin because of lack of snow surveys.
[2] From floating pan at Tahoe City.
[3] At Clifton, 20 miles below Empire. Probable correction 5 per cent; seasonal, 66 31 and variation 30.1.
[4] Interpolated from Carson River.
[5] Maximum rise accelerated three weeks by high temperatures. If corrected for evaporation to normal date of maximum rise seasonal percentage of run-off would be 60 89 and variation 42.1.

TABLE VI. SHRINKAGE IN EXPECTED RUN-OFF BELOW DIVERSIONS: APRIL-JULY, 1920 (CARSON BASIN WITH TAHOE AND WEST WALKER BASINS AS CHECK)

Basin	Expected Run-Off — Seasonal 1919-20 — Normal (Acre-Ft. or Feet Rise)	Per Cent	Acre-Ft. or Feet Rise	Diversions (Acres of Land)	Actual Run-Off — Acre-Ft. or Feet Rise	Per Cent or Normal	Diminution (Per Cent of Normal)
Carson (Empire)	246,412 a.-ft.	70 0	172,488 a.-ft.	27,000	97,496 a.-ft.	39 6	—30 4
Tahoe	1.66 ft.	50 2	0.83 ft.	None	0.89 ft.	53 6	+ 3 4
West Walker	190,366 a.-ft.	74 8	142,394 a.-ft.	Small	164,100 a.-ft.	86 2	+11 4

weather, and hence may be considered a fixed quantity for its particular basin, it becomes a factor of increasing effect as the snow cover exceeds or falls below its normal.

For example, the normal snow cover of the Tahoe basin estimated quantitatively by the method of areas is 22.7 in. water content and the amount of absorption in priming the soil theoretically determined is 8.6 in., or 37.9 per cent. On this basis the ratio of increase in deficiency is as shown in Table IV. The converse should be true also when the seasonal percentage of the snow cover is above normal. However, when compared with the run-off of seasons of deficient and excessive snow cover (see Table V) this ratio seems too large and should be applied with caution.

Shrinkage in the expected flow below diversions is similar in effect to sub-normal snow, for not only is the ratio of decrease progressive but the land is thirstier because of the general dryness of the season. In years of heavy precipitation the diversions have but little effect upon the seasonal percentage, as based upon the snow fields. One of the experiences of the present season is shown in Table VI.

This shrinkage is shown conspicuously in the increased ratio of use of water in the Truckee meadows, which consist of approximately 14,000 acres of irrigated and swamp land around Reno, Nev. According to a table prepared for water users by C. A. Norcross, University of Nevada, the average difference in the flow of the Truckee River above this diversion for five years of sub-normal snow was 99,587 acre-ft.; but for four years which were over-normal in snow and one which had copious summer rains the difference was only 54,746 acre-ft., the ratio of "overuse" being thus 81.9 per cent. A portion of this "overuse" is probably only apparent, for part of the supply of the meadows, estimated at a normal of 22,000 acre-ft., comes from sources other than the Truckee.

This shrinkage shows the need of testing estimates of seasonal run-off by obtaining data above all diversions. But it demonstrates more particularly the need of special forecasts for each section that is handicapped by large upstream diversions.

Most of the factors mentioned in the above discussion are illustrated in Table V, based upon four seasons of deficient precipitation during run-off, with six check seasons of normal spring and summer rainfall. A lake and a river basin adjoining each other, and consequently having similar weather, are represented to show the divergence between the types.

In that table the dominant and consistent correlation is the precipitation, the river basin being less affected by extremes than the lake basin. The priming of the soil by autumn rains or winter run-off presents constant contradictions. The effect of the extremely sub-normal years of 1911-12 and 1912-13 is clouded by excess precipitation, and shrinkage below diversions during these years does not appear, possibly also because of the summer rainfall. During the season of 1919-20, in which the snow forecast was approximately 20 per cent below normal, and the summer rains, except for two heavy showers, were entirely lacking, the diminution seems to have been as high as 30 per cent.

April Precipitation—The precipitation factor in Table V is made more obvious by the preponderance of the April or April-May precipitation over the remaining precipitation in the seasons of 1913-14, 1914-15 and 1916-17. Thus, in the Tahoe basin in 1913-14, with an April normal of 1.78 in., 2.29 in. fell in a total of 3.79 in.; in 1916-17, 2.32 in. out of a total of 3.04 in. In 1914-15, although only 0.54 in. out of 4.44 in. fell in April, this was supplemented in May by 3.70 in., an amount 132 per cent in excess of the May normal.

In the Tahoe basin the normal April precipitation is estimated at 10.6 per cent and the May precipitation at 9.5 per cent of the normal winter snow cover, while the precipitation for June is only 2.7 per cent and that for July 1-15 is negligible. Thus, in view of the continuous melting of the snow fields after March 15 and the increasing area of exposed soil, the precipitation for April should indicate the probability of normality or shrinkage in the seasonal run-off. It is possible, however, that the May precipitation at times may become the deciding factor, or that concentrated rain, as in the present season, may complete the monthly or seasonal normal and leave bright skies to accelerate the evaporation. But this latter effect is only partial as compared with total lack of rain.

Acceleration of Run-Off—Acceleration or even retardation of snow melting does not necessarily mean abnormal increase or decrease in the relative seasonal run-off, for the melting when once begun is almost continuous. Consequently, the soil has no opportunity to dry out and the total variation in run-off is probably less than 8 per cent.

It is a striking fact that in all of the seasons of abnormal shrinkage in run-off shown in Table V the seasonal temperature during run-off was from 0.7 to 4.2 deg. F. in excess of normal. This temperature was 2.5, 0.7, 3.0 and 4.2 for the seasons of 1909-10, 1915-16, 1917-18 and 1918-19 respectively. Its principal effect

TABLE VII. EFFECT OF TEMPERATURE IN CAUSING PREMATURE RUN-OFF WITHOUT COMPENSATING GAIN IN SEASONAL ESTIMATE

(Run-Off, Carson Basin, 1918-19. Temperature at Reno)

Snow Cover Apr. 1 (per Cent. of Normal)	April — Excess Temp. (Deg. F.)	April — Run-Off (per Cent. of Normal)	May — Excess Temp. (Deg. F.)	May — Run-Off (per Cent. of Normal)	June — Excess Temp. (Deg. F.)	June — Run-Off (per Cent. of Normal)	July — Excess Temp. (Deg. F.)	July — Run-Off (per Cent. of Normal)	April-July — Excess Temp. (Deg. F.)	April-July — Run-Off (per Cent. of Normal)	Variation Between Run-Off and Snow Cover per Cent. of Normal
96 8	+2.1	86.44	+7.2	115.24	+1.8	27.56	+5.7	3.95	+4.2	66.58	—30.2

TABLE VIII. LACK OF CORRELATION BETWEEN LIGHT DENSITY OF SNOW COVER AND EARLY MAXIMUM RUN-OFF. (CARSON RIVER BASIN)

Year	Snow Cover in Tahoe Basin (per Cent of Normal)	Excess or Deficiency in Density of Snow (per Cent)	Excess or Deficiency Temp. from March to Month of Maximum Acceleration Inclusive (Deg. F.)	Month of Maximum Run-Off (Normal Month May)	Percentage of Monthly Normal Run-Off to Show Acceleration (Maximum Acceleration Underscored) March	April	May	June	July	August
1909–10	83.3	+3.3	+7.5	May	134.43	127.66	74.54	34.18	19.01	
1910–11	167.5	+2.4	+0.7	June	142.01	135.63	113.05	236.24	258.36	161.10
1911–12	49.9	—9.5	—1.2	June	37.0	7.62	52.78	61.83	12.61	
1912–13	58.3	—8.2	+0.6	May	44.35	57.09	92.35	36.26	14.0	
1913–14	154.1	+12.2	+4.2	May	162.10	163.29	178.65	148.95	156.06	141.57
1914–15	88.4	—5.2	+2.0	June	71.40	95.23	83.11	108.69	77.16	
1915–16	152.2	+6.7	+4.4	May	134.39	161.95	121.58	118.52	101.40	

was to run the moisture from the snow fields prematurely, without noticeably increasing the total seasonal flow, as shown in Table VII.

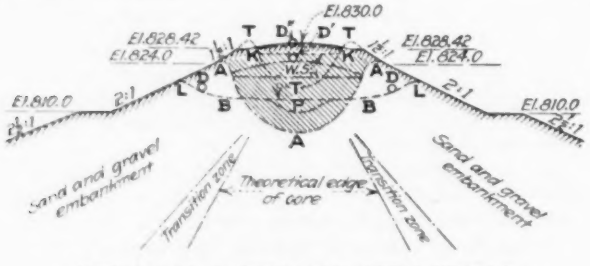
Although the May flow is 18.4 per cent above that of the snow cover, the June flow falls to a deficiency of 69.2 per cent, while the July flow is negligible. The total seasonal loss of 30.2 per cent, due to lack of rains, is so large that little compensation can have come from the accelerated melting, but it is possible that the increased ratio of shrinkage below diversions accompanying sub-normal run-off may have clouded the result.

Light Density of Late Snows—That mountain snows have a tendency to run off prematurely is not proved by data so far gathered. The fact rather is that these snows pass through a process of accelerated ripening due to the alternation of thawing and freezing that occurs normally in April above the elevation of 7,000 ft. For example, at Summit Station, California, in 1917-18, the relative density of the snow field for its entire depth was only 36.6 per cent on March 24, but on April 15 this density had increased to 49.2 per cent with a loss of only 3.3 in. above the current precipitation in a total snow cover of 32.8 in.

It is true that snow of light density at the beginning of the time of melting, before losing its water, fails to attain the density of snow of higher initial density. But the maximum seasonal variation in density for the Tahoe basin as a whole is under 13 per cent, and no marked effect from light densities appears in the run-off. This is shown in Table VIII by the lack of correlation between light density and the advancement of the month of maximum run-off or even of acceleration in the melting, due mainly to excess of temperature.

Method of Capping Hydraulic Fill Germantown Dam

A PUDDLE crown completes the hydraulic fill embankment of the Germantown Dam. This crown was placed during September and October of last year by hydraulic filling in connection with dragline excavating. Approximately 95,000 cu.yd. of puddle were placed, completing an embankment of 797,907 cu.yd., and, except for minor finishing operations, the first of the large retarding basin dams of the Miami River valley flood protection works.



METHOD OF CAPPING OUT GERMANTOWN DAM EMBANKMENT

To about El. 815 the embankment was completed by the regular hydraulic fill process described in *Engineering New-Record* Sept. 23, 1920, p. 600. At this level the top of the fill displayed the characteristic parallel levees and beaches, with the core pool in the center, as indicated on the accompanying sketch by the line *LBPBL*. Here the distinction between fine core and outside embankments of coarser material was abandoned and a full width cap of fine and coarse material puddled together was substituted. The reasons for this change were that as the fill narrowed it was difficult to maintain distinctive beaches and core by hydraulic fill; that above this level the heads of water at extreme flood level will be insignificant and the mixed material is sufficiently impervious to resist them; and that a top to the embankment was desired which would become immediately solid for the roadway along the crest.

With the top at *LBPBL*, a dragline excavator was run along the beaches scooping out the pool and building up the levees to about the line *AAA*. With a single dredge discharge pipe line at *D'* the excavation was filled with mixed coarse and fine material to the line *KK*. The dragline then scooped out the trench *TT'T'*, which was in turn filled by the dredge pipe at *D''* to the crest level of the embankment. The remaining work was merely a finishing operation. The dragline trenching besides serving the construction purpose described also served the structural purpose of securing a well-mixed top material for the dam.

The construction of the Germantown Dam was under the direction of the Miami Conservancy District, Arthur E. Morgan, chief engineer; Charles H. Paul, assistant chief engineer, and C. H. Locher, construction manager. A. H. Pauls was division engineer in immediate charge of construction.

Iowa Prohibits Stockpiles on Subgrade

The placing of loads or piles of aggregate on the subgrade or shoulders to be wheeled, shoveled or conveyed directly to the mixer is not permitted in the 1921 specifications for concrete road of the Iowa State Highway Commission.

The Sewage Treatment Plant at Newton, Kansas

Sludge from Secondary Settling Tank and Effluent from Sludge Bed Returned to Inlet of Imhoff Tank

By Ivan S. Siegrist

Assistant Engineer with Black & Veatch, Consulting Engineers, Kansas City, Mo.

A SEWAGE treatment plant has recently been completed for Newton, Kan., which has several distinctive minor features, especially the means of protecting the plant from floods, and of returning to the incoming sewage the sludge from the secondary settling tank and also the effluent from the sludge filter. The plant comprises a small pumping station with Imhoff tanks, a dosing tank, sprinkling filter, final settling basin and flood-control manhole.

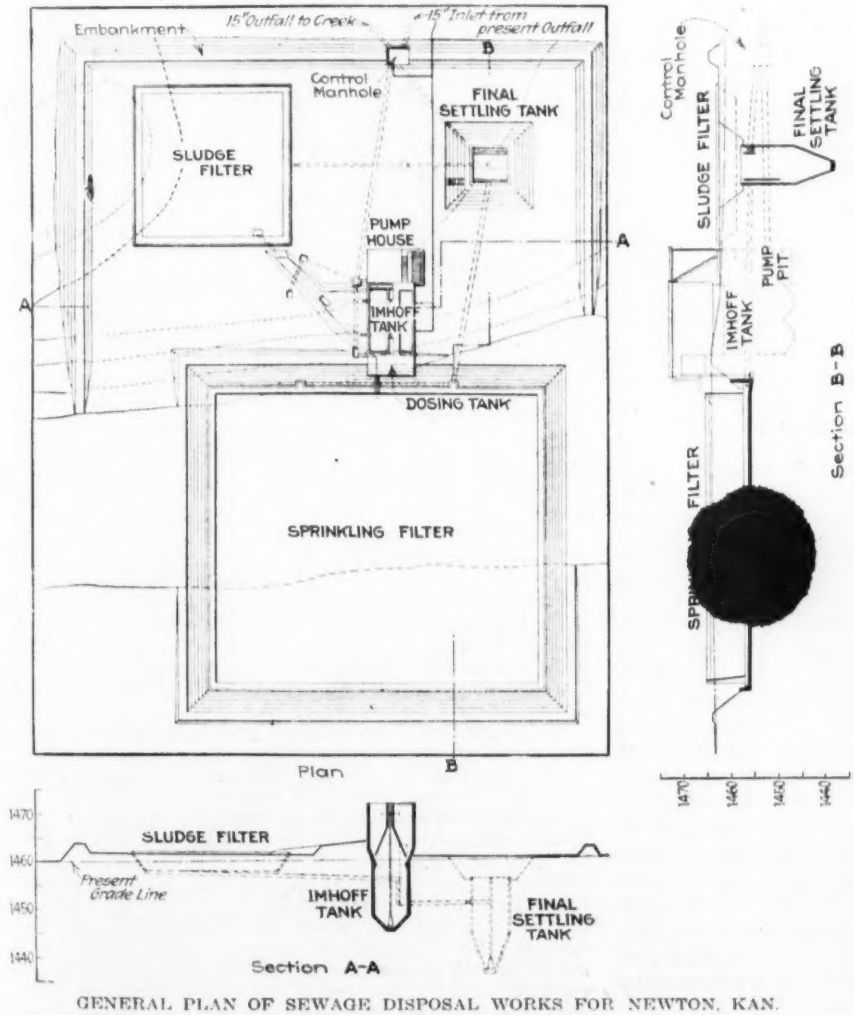
Newton has a population of 8,000 and the sewage to be treated is practically all residential. Sand Creek, into which the sewage is discharged, has an intermittent flow, at times so small as to afford almost no dilution. A considerable degree of purification is therefore required.

The former plant consisted of a one-story septic tank that was in bad condition and yielded unsatisfactory effluent. It had been proposed to use this tank as part of the new plant, but on account of its condition and the difficulty of fitting it into a plant having secondary treatment it was decided to build a complete new plant, on an adjacent site, keeping the old tank in service through the construction period.

On account of the low elevation of the outfall sewer the sewage must be pumped. The flow passes through an inclined bar screen of 1-in. clear opening, into a reinforced-concrete wet well with a capacity of approximately 3,000 gal. Two 300-gal. per minute vertical centrifugal pumps, direct-connected to electric motors, are automatically controlled by floats in the wet well. There is a conection from the pumps direct to the outfall sewer for use in case of extreme high water.

The sewage passes from the pumps to the rectangular horizontal-flow Imhoff tank, an end of which forms one wall for the pump pit and house. This structure projects some distance above the ground, due to the rather flat topography of the site and the head required for the sprinkling filters.

The two settling compartments are designed for a 1-hr. detention of the maximum flow. No inlet weir is used, thus eliminating deposit of sediment. The effluent falls directly into the dosing tank over a weir in the outlet end. No other baffles are used than scum baffles at each end of the tank. The slot leading to the sludge compartment is 6 in. wide with 6 in. lap. The sludge compartment is designed for five months' detention of deposits and may be flushed from rings of lead pipe.



GENERAL PLAN OF SEWAGE DISPOSAL WORKS FOR NEWTON, KAN.

Sludge from the Imhoff tank is discharged onto a 60 x 60-ft. sludge drying bed built of crushed stone (a 6-in. layer ¼ to ¾ in. and an 8-in. layer ¾ to 2 in.) covered with 4 in. of sand. The underdrain laterals are lines of 6-in. tile laid with open joints, 6 ft. 5½ in. c. to c. They connect with an 8-in. central collector. The sloping sides of the filter are paved with concrete.

The effluent from the sludge filter, instead of being discharged into the stream, flows into the line which leads to the pumps and is retreated. Thus nothing but the settled effluent from the sprinkling filter reaches the stream.

A reinforced-concrete dosing tank, which receives directly the effluent from the Imhoff tank, is designed to have a capacity equal to 12½-min. flow at the average daily rate. It is shaped to give a uniform dose, and contains a 14-in. siphon.

The sprinkling filter material is crushed rock, having an average depth of 7 ft. The bottom is paved with concrete and a dry stone wall extends around the filter. The distribution system is of 6-in. tile encased in concrete, with wrought-iron risers. Worcester ⅝-in. nozzles are used, located at the corners of equilateral triangles 12 ft. on a side. The underdrains are of 8-in. split tile, 2 ft. c. to c., draining to covered gutters. Both gutters and split tile are carried through the outer wall at their upper ends for flushing.

In designing the sprinkling filter it was assumed that 11 grams of nitrogen is produced per day per capita, and that each cubic foot of filtering material can take care of 0.75 gram. This gives a loading of 2,970 population per acre per foot of filtering material.

Following the sprinkling filter is a final settling basin, designed for 1-hr. detention of the average flow. This basin is of reinforced concrete, with a hopper bottom, and is 19 ft. deep. It has a deep inlet baffle

SPRINKLING FILTER BEFORE FILLING WITH DRY WALLS THROUGH WHICH UNDERDRAINS EXTEND

and a shallow outlet baffle. The sludge may be blown out of the bottom through cast-iron [illegible] and a bell mouthpiece, in the same way as fro[illegible]ff tank. On account of the probable difficul[illegible]ng the sludge, it is not piped to the sludge [illegible]mptied into the incoming sewage. This [illegible]nt was adopted not only because of the advantage in operation, but also because it gave a simpler and more economical layout than any other scheme for handling the sludge. From the final settling tank the treated sewage flows into the second compartment of the control manhole and thence to the creek. On the line into the plant which passes through the first compartment is a hydraulic gate valve. A float in the second chamber controls this valve through a pilot valve, and cuts off the flow to the pumps when the water in the creek reaches a point where backwater might damage the plant. The sewage then rises in the first compartment and flows into the second compartment through a flap valve. Another flap valve prevents water backing into the plant. The lower part of the grounds is protected by a dike.

The plant was designed and construction was supervised by Black & Veatch, consulting engineers, Kansas City, Mo. Ralph B. Reeves was their resident engineer. The Chanute Construction Co., Chanute, Kan., was the general contractor.

Denies Further Extension of New York Piers

Secretary of War Orders City To Put Hudson River Piers in Chelsea Section of Manhattan Back to Original Line

UNDER date of Jan. 17, 1921, Secretary of War Baker wrote to Murray Hulbert, Commissioner of Docks, New York City, refusing to make permanent the temporary order of 1911 permitting the city to extend three piers in the Chelsea district of the Hudson River. By order of the secretary these three piers must be shortened to the established pierhead line before May 21, 1921. The major parts of the secretary's letter are as follows:

Referring to the application of Jan. 28, 1920, on behalf of the authorities of the City of New York for an extension channelward of the North River pierhead line between Perry St. and West 72d St., in order to legalize the extension of the Chelsea piers and to provide for extensions elsewhere, I have to say that the statements and arguments presented at hearings given in my office on Nov. 8, 1920, to the interests you represent, and on Dec. 11, 1920, to representatives of the Board of Commerce and Navigation of the State of New Jersey, have been fully weighed and considered. I have also visited New York and personally inspected the locality. In view of those proceedings and of the public hearing held by the New York Harbor Line Board on March 4, 1920, I feel that all interests have had full opportunity to present their views concerning the questions involved and that with the additional information afforded by the comprehensive reports of the board and the Chief of Engineers all information needful for the decision of the matter is now before me.

I find that your application is a repetition of others made to the Department from time to time since 1903, all of which were made the subject of hearings and reports by the New York Harbor Line Board and which were decided after a thorough consideration by different Chiefs of Engineers and by five different Secretaries of War.

It appears that those decisions were based upon evidence that there has been a serious encroachment upon the waterway at the point in question, reducing the channel width below the minimum considered necessary for the safety of navigation, thus creating an increase of about 60 per cent in tidal velocity, and showing a tendency to interfere with the river action necessary to preserve navigation facilities in other reaches. It also appears that the necessity of providing long slips on the Manhattan shore for the berthing of large steamers was recognized in connection with the requests referred to, and that a change of the pierhead line was permitted between the Battery and the foot of Gansevoort St. which would enable the city to construct piers over 1,000 ft. without further narrowing the Chelsea gorge.

At the hearing held by me on Dec. 11, 1920, the representatives of the New Jersey Board of Commerce and Navigation directed attention especially to the change below Gansevoort St., stating that the action was in accordance with an agreement between commissions of the States of New York and New Jersey and the Federal Government, and they expressed, in effect, the feeling that the matter of the proposed extension at Chelsea having been settled at that time, the State of New Jersey should not again be put to the trouble of objecting to it.

They also called attention to the greater physical difficulties of obtaining long slips on the New Jersey side on account of the adjacent high land and to the slight advance which has been made channelward of the New Jersey harbor line as compared with that on the New York shore. They stated that plans are in hand for the construction of extensive terminals for the berthing of large ships on the New Jersey side immediately opposite Chelsea, and that notwithstanding the physical difficulties referred to the construction will be such that vessels lying in the terminal slips will be entirely shoreward of the harbor lines. The traffic at those terminals will undoubtedly increase the congestion of the waterway in the Chelsea section.

The reports of the New York Harbor Line Board and the Chief of Engineers give data confirming the statements regarding harbor line concessions made to enable the City of New York to construct elsewhere than at Chelsea piers necessary for the berthing of large ships, and show that in view of an explicit understanding and assurances that the city would take such action the Secretary of War authorized as a temporary expedient; namely, the extensions which you now wish made permanent. They also confirm the statements concerning the narrowing of the river at the locality and adhere to the views that the existing width of the waterway at Chelsea is less than is considered essential for the safety of navigation; also that the increase in tidal velocity caused by the contraction in width is objectionable, and that the encroachment has shown a tendency to interfere with the navigable condition of the river in other reaches.

I find nothing in your application or in your presentation of the matter which would justify the granting of your request, either on legal or equitable grounds. So far as the equities of the case are concerned it would seem that if any further advance of harbor lines at the locality is to be permitted the privilege should certainly be given to the State of New Jersey and not to the City of New York. My decision, however, must be based not upon the equities, but upon the law governing the matter found in Section 11 of the River and Harbor Act of March 3, 1899, which provides that harbor lines may be established where it is made manifest to the Secretary of War that such action "is essential to the preservation and protection of harbors." It is my view that in applying that law it is my duty to consider not merely the requirements of a particular limited section of waterfront and the needs of the immediate present, but rather the interests of the entire waterway affected and the probable demands of the future. The evidence before me is, so far as the present is concerned, that the encroachment at Chelsea, instead of preserving and protecting the harbor is a damage and a menace to it and to other sections of the waterway. It further develops that the City of New York has ample space for providing berths for large ships elsewhere on the Hudson front as well as at other points in the harbor.

So far as concerns the future, it appears highly improbable that commercial developments above Chelsea have reached their ultimate limit and that navigation yet feels the full burden of the contraction of the waterway at that locality. From the standpoint both of the present and the future, therefore, I cannot consent to a longer continuance of the temporary encroachments now existing and could not assent to a permanent narrowing of the channel to its present limits at that point were that matter now before me as a new proposition.

I am consequently constrained to deny your application and to direct that immediate steps be taken to remove the temporary piers, the work to be completed not later than May 1, 1921. I will give the Chief of Engineers instructions to defer commencing any legal action until that date, provided assurances are received from you in the near future that the work of removal will be undertaken in accordance with this notice.

Road Grading Methods and Costs in Nebraska

Ten-Ton Tractors Operating Elevating Graders Show Decided Economy Over Team-Operated Grader Outfits

By George E. Johnson
Secretary, Department of Public Works and State Engineer, Nebraska

STATE road construction in Nebraska has been largely a task of producing permanent road beds. On the theory that a perfect earth-road grade is the first essential in constructing a permanent paved road, the grading and drainage of earth roads has been prosecuted intensively. As the work has advanced, team grading, tractor grading and dragline grading are the three leading methods which have been developed. A comparison of these methods, based on a wide range of conditions and giving representative costs, is instructive.

With 80,000 mi. of earth roads it is impossible to

TEAM-OPERATED ELEVATING GRADER OUTFIT

pave any appreciable mileage without first a large amount of grade development. Grade is the initial step toward permanent construction. The state highway department has acted upon this theory and has undertaken, ahead of all other work, to grade, straighten and drain the 4,500 mi. of earth roads which compose the state system. The program was started in 1917. To date the [illegible] has under construction 1,311.57 mi. of road[illegible] as follows: Earth road, 1,215.51 mi.; hard s[illegible] 17.33 mi.; sand-clay road, 55.7 mi.; and gr[illegible]3.03 mi. This work, under contract, will cos[illegible],359.

A program of this character is not sacrificing funds for "temporary earth roads" but is making for permanent highways by preparing a perfect road bed for surfacing that is to follow when supplementary funds will permit.

Of the 4,500 mi., which constitute the state highway system, nearly 3,000 mi., are of earth construction and no two roads are of the same character. There are known to be ninety-three kinds of soil ranging from sticky gumbo to pure blow sand. Because of this diversity of soil texture variety in methods of grading and a multiplicity of equipment are required.

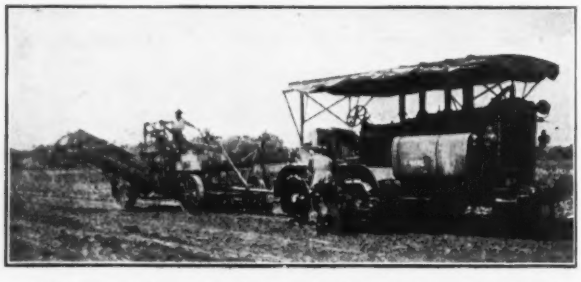
There are three distinct methods under which all grading work in the state is classified: (1) Team grading; (2) tractor grading; and (3) dragline grading.

The excavating tools and grading procedure are sub-

stantially identical in team grading and in tractor grading. The major tool is the elevating grader for the larger cuts and fills. For lighter excavation, blade graders are used and for short-haul (under 300 ft.) earth movements the Fresno scraper is economical. The standard earth road section is 24 ft. wide with a 6-in. crown from the shoulders; the ditches have 1 on 1½ back slopes and 1 on 3 front slopes.

Ordinarily, sixteen horses and three men constitute an elevating grader equipment with from three to nine teams hauling dump wagons. On one job with heavy cuts and a long haul a fourteen-wagon outfit was required to handle the grader output. With tractor haulage the wagon outfit is increased to handle the increased output. Tractor operations are gaining in favor. Generally speaking, Nebraska road contractors are convinced that with tractors labor is saved, the quantity of earth moved is increased, greater ease of operation is secured and costs are reduced.

A tractor-drawn outfit has an advantage over a team-drawn outfit; first, because the contractor, with the stock he has on hand necessary to operate his team-drawn outfit, can, by the addition of a tractor and an increased number of wagons, practically double the output of material. The horses released by the tractor



TRACTOR OPERATED ELEVATING GRADER OUTFIT

work can be used for the actual placing of the earth. In the majority of cases, from twelve to sixteen horses are released. Again, where there are three men required to operate the horse-drawn outfit, but two are required on the tractor work, one for the elevator and one for the tractor. With this outfit, the work progresses more steadily, as it is not necessary to stop and rest the horses. The tractor can turn easier and in less space than is necessary for a team[illegible] outfit.

The experience of this department [illegible] that for the past two seasons the 10-ton cat[illegible]tor has been very successful as a motive po[illegible]levating graders. The work of maneuvering the e[illegible]g grader in the narrow cuts is facilitated where the tractor is used. Breakdowns have been very infrequent. In one instance, the tractor worked the entire season continuously and was held up for repairs but one day in the late fall of that year. However, this factor is almost entirely under the control of the mechanic whose duty it is to keep the tractor in perfect working order. One contractor, within the past month, has ordered eleven 10-ton tractors, and another has ordered five 10-ton tractors.

A cost comparison of team-drawn and tractor-drawn grading outfits is impossible because of the wide variation in the condition of the soil, weather and labor. This conclusion is arrived at after a complete analysis of roads built by both types of outfit. Taking projects that are considered fairly representative of the two

DRAGLINE ROAD GRADING OUTFIT

methods of work, I have attempted to compare them for a period of three months, with respect to cost per cubic yard, contract price, yardage moved and profit. These figures are submitted in Table I as proof that it is impossible to analyze or actually compare the earth construction work in the state, because yardage which is the basis of grading operations, is dependent upon seven factors: (1) Condition of the soil, (2) depth of cut or fill, (3) length of haul, (4) type of equipment, (5) weather, (6) labor, and (7) management.

As a general indication of the range of costs, figures selected from a number of operations run as follows in cents per cubic yard for team-drawn elevating graders: 37.6, 37, 51, 51.2, 36.5, 37, 38.5, 38.6 and 31.9. For tractor-drawn graders the figures are: 41, 35, 29.6 and 38.6c.

One of the largest contractors in the state recently stated that he had found it much cheaper to work with tractors pulling grading machines than with teams. He said: "On one project I have two twenty-team outfits, two grading machines and twenty wagons. The cost of operating these two outfits per month is $13,400, which is $6,700 per month for each twenty-team outfit. I have several tractor outfits working in different places. The expense of these outfits averages about $5,250 per month, thus making the tractor expense $1,450 a month less than the team outfit."

Finishing Methods

Before taking up the third type of equipment used in road construction in Nebraska attention will be called to the question of the proper finish. This is the most important matter in the construction of earth roads. After the work has been brought to grade, finishing stakes are set by the engineer and the contractor blades his road continuously until a smooth, compact surface is secured as indicated by the stakes.

Finishing the back slopes raises the question whether hand dressing is required. If a contractor is careful, he can slope his cuts in such a way that the terraces made by his disc are so slight that the action of the weather will soon put them in satisfactory shape, and when the weather is not favorable, a once-over with the mormon will show a workmanlike job. Some contractors are careless and butcher their work in such a way that a mattock is the only tool that will correct the rough work on the back slopes. Usually the type of finishing is governed by the depth of the cut; on shallow work finishing is not necessary. As a rule the department does not require handwork on back slopes. There are several attachments for an elevating grader

which will cut back slopes and it is possible to cut slopes as high as 6 ft. with a blade grader.

The finish of the road is important, for the verdict passed by the traveling public, whether a road is good or bad, is based entirely upon how it rides and how it looks.

Dragline Grading Operations

The third type of equipment used in building roads in this state is the drag-line excavator. There are several of these in operation in the state, but as a general rule the machine is not in common usage except where unusual conditions exist. Where there are long fills taken from low wet places the drag-line excavator is unexcelled. Ordinarily, tractor- or team-drawn outfits are impracticable under such conditions and often quite impossible. The equipment consists of a drag-line excavator, equipped with a shovel and provided with widespread traction wheels or the caterpillar type of tread; and of two teams, a fresno, a mormon and a blade grader. The contractor's force consists of a superintendent and four men, two of whom operate the dragline. The operation is simple: The boom swings out, lowering the bucket at the end of the cable to the material, fills, swings back, and deposits the excavated earth on the fill. In order to get earth across a creek bottom for construction on one project, 8 mi. in length, it was necessary to dig deep side ditches on both sides of the road. At three different times the work was completely under water, but construction was not hampered. Herein lies the advantage of dragline excavator. On this particular piece of work the grade was raised 3 ft. and the entire surrounding country was level. This proved to be the most economical method, as there was no earth to be hauled since the excavated material from the ditches formed the grade. However, here again enter the factors of soil conditions, labor and yardage placed. The economy of the operation is mainly dependent upon a proportioned combination of existing conditions, power and capacity of the machine, and the brains and experience of the operator.

TABLE I. COMPARISON OF ROAD GRADING OPERATIONS WITH RESPECT TO CONDITIONS EFFECTING YARDAGE

Item:	1	2
Soil	Loose	Loose clay
Weather, rained, days	2	6
Number of men, average	48	23
Lost man-hours	514	1,166
Lost team hours	8,348	2,761
Lost tractor hours		121
Yards moved	58,368	67,571

Eight miles of an average 3-ft. fill were built across a creek bottom by an excavator, equipped with 1-yd. dragline in a reasonable length of time. Two men operated the machine and with an uninterrupted run of ten hours it placed 500 cu.yd. of earth. It goes without saying that there was considerable finishing work.

Strong Railing for Highway Bridges

Railings of highway bridges should be designed so as to be capable of withstanding the impact from unmanageable vehicles, according to the view of the New Jersey Highway Department. To this end monolithic concrete railings with reinforcement and anchorage to bridge decks have been designed. It is stated that such a railing can be produced at a cost about equal to that of heavy galvanized pipe railing, and is vastly superior to it in strength, endurance and appearance.

Federal Reserve Board's Report on Building Activities

IN ANALYZING the reports of its member banks on building activities during December, 1920, the Federal Reserve Board makes the following statement:

For the first time in some months an increase in the value of permits issued is shown in some districts in December. The number of permits issued, however, with the exception of scattered centers, has continued the decrease characteristic of preceding months. The building contracts awarded in New York State and northern New Jersey, District No. 2 (New York), according to the reports of the F. W. Dodge Company, were 616 projects at a cost of $17,000,000 for December, while in November there were 694 projects at a cost of $29,500,000. In District No. 3 (Philadelphia) the decrease was largest, being from $2,303,445 to $1,443,715.

In District No. 4 (Cleveland) the number of permits issued decreased, but there was a very large increase in value, this being $8,976,700 in December as against $5,901,026 in November. The value of permits issued in Cleveland alone increased from $2,402,100 in November to $6,391,994 in December. During December a decrease was shown in practically every city in District No. 5 (Richmond) when compared with the same month a year ago, the value being only about 40 per cent. In District No. 6 (Atlanta) large decreases were noted in the leading cities, while some increases were noted in some of the smaller cities.

It is reported in District No. 8 (St. Louis) that "a heavy slump in number of building permits and dollar values involved is shown in reports of leading cities of the district for December. Virtually nothing in the way of new construction is being undertaken at the moment." In District No. 9 (Minneapolis) December building operations, when measured by number of permits, decreased one-third from the November figures, but the valuation increased 21 per cent, due entirely to Duluth and Superior operations, which cities alone showed an increase in valuation. Minnesota alone showed an increase in the number of permits issued.

District No. 10 (Kansas City) states that "the showing made by the December reports on building was somewhat better than anticipated." There was a decrease in every leading city of District No. 11 (Dallas), with the exception of Shreveport, La., as compared with the previous month. When compared with the closing month of 1919 there was a decrease of 66.8 per cent for the nine leading cities, Austin and Beaumont being the only cities showing increases. District No. 12 (San Francisco) reports that "Building activity in this district during December, 1920, was 5.8 per cent greater than that of November. Eac[illegible] the principal centers except Los Angeles, where a [illegible] of 39.3 per cent in the value of permits occurred[illegible]ted an increase in value but a decrease in the num[illegible] permits issued.

The dec[illegible]e in operations in Los Angeles is attributable to the high record attained during November.

Jamestown Municipal Milk Plant Delayed

Construction of the proposed municipal milk bottling, pasteurizing, and distrubuting plant for the city of Jamestown, N. Y., noted in *Engineering News-Record*, Oct. 21, 1920, p. 792, has been delayed by difficulty in selling the $150,000 of city bonds voted for the purpose in August, 1920. A bond house whose bid for the bonds the city accepted subsequently refused to take the bonds, giving as its reason a question as to the legality of the city going into the milk business. We are informed by Lyman P. Hapgood, the superintendent of the city water and light plant at Jamestown, that the city now proposes to try to dispose of the bonds at private sale.

Build Bridge Across the Colorado in Grand Canyon

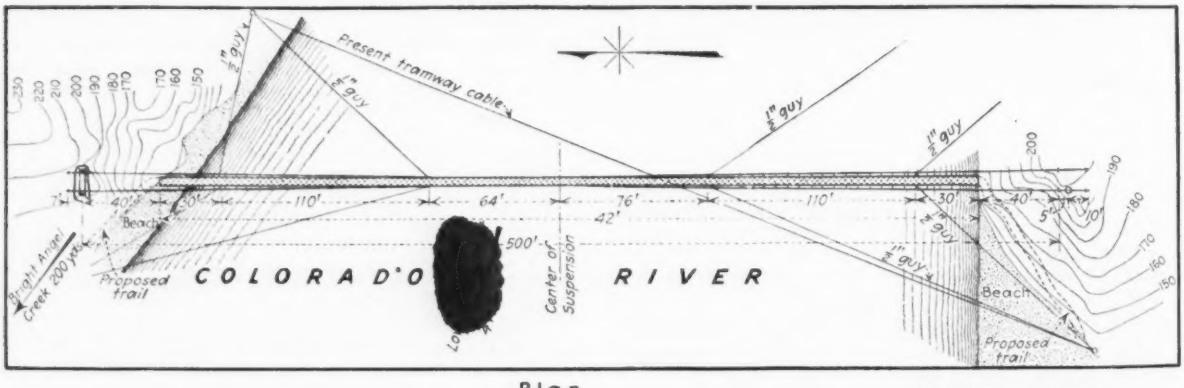
Material for Only Crossing Above the California Line Has to Be Packed Down Canyon Trail

AT THE bottom of the Grand Canyon of the Colorado —nearly 5,000 ft. below the rim at El Tovar—the United States through the National Park Service is now building a suspension bridge across the Colorado River, the only bridge crossing of that river above Needles, Cal., which is over 500 miles below where the Grand and the Green join to form the Colorado. The bridge is for mule trains and foot passengers and is of the simplest design, not only because of the light loading but also because all of the material and construction equipment have to be packed by mule trains down the narrow and steep trails of the canyon.

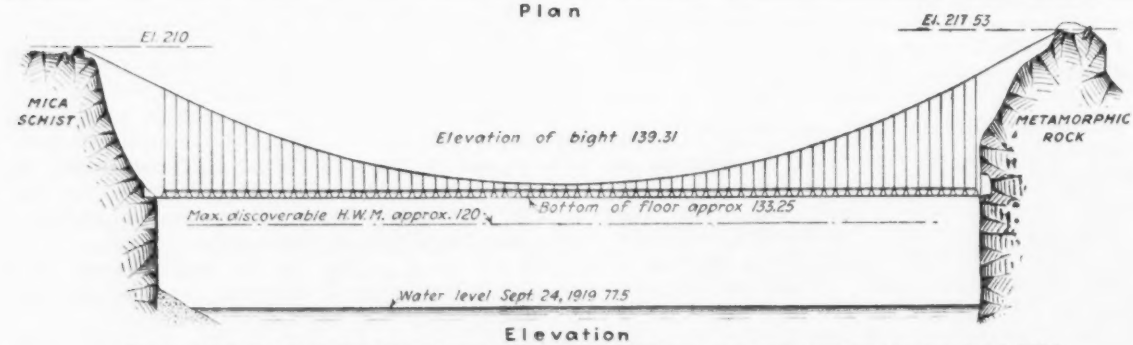
Access to the Grand Canyon is confined practically entirely to the railroad leading up from Williams, Ariz., which reaches the south rim at El Tovar, and by highways from Williams and Flagstaff, Ariz. From there tourists may be sent into the canyon by foot or on muleback on two or three separate trails. The north rim of the canyon has heretofore been difficult of access, although there is a camp opposite El Tovar which is reached by horseback from railroad points in Utah many miles north. This north rim is about 1,500 ft. higher than the south rim and presents a view entirely different from what is usually seen. For this reason the Park Service, which has only recently taken over the Grand Canyon, has decided to build the bridge across the river and extend the trail up by Angel Creek on the north side of the canyon to the north rim, thereby making available a new scenic trip for tourists.

The site selected for the bridge is just above the mouth of Bright Angel Creek, a distance perhaps of 9 or 10 miles by trail from Grand Canyon station at El Tovar. It is a narrow rock gorge having quite

SWIMMING HORSES ACROSS COLORADO RIVER

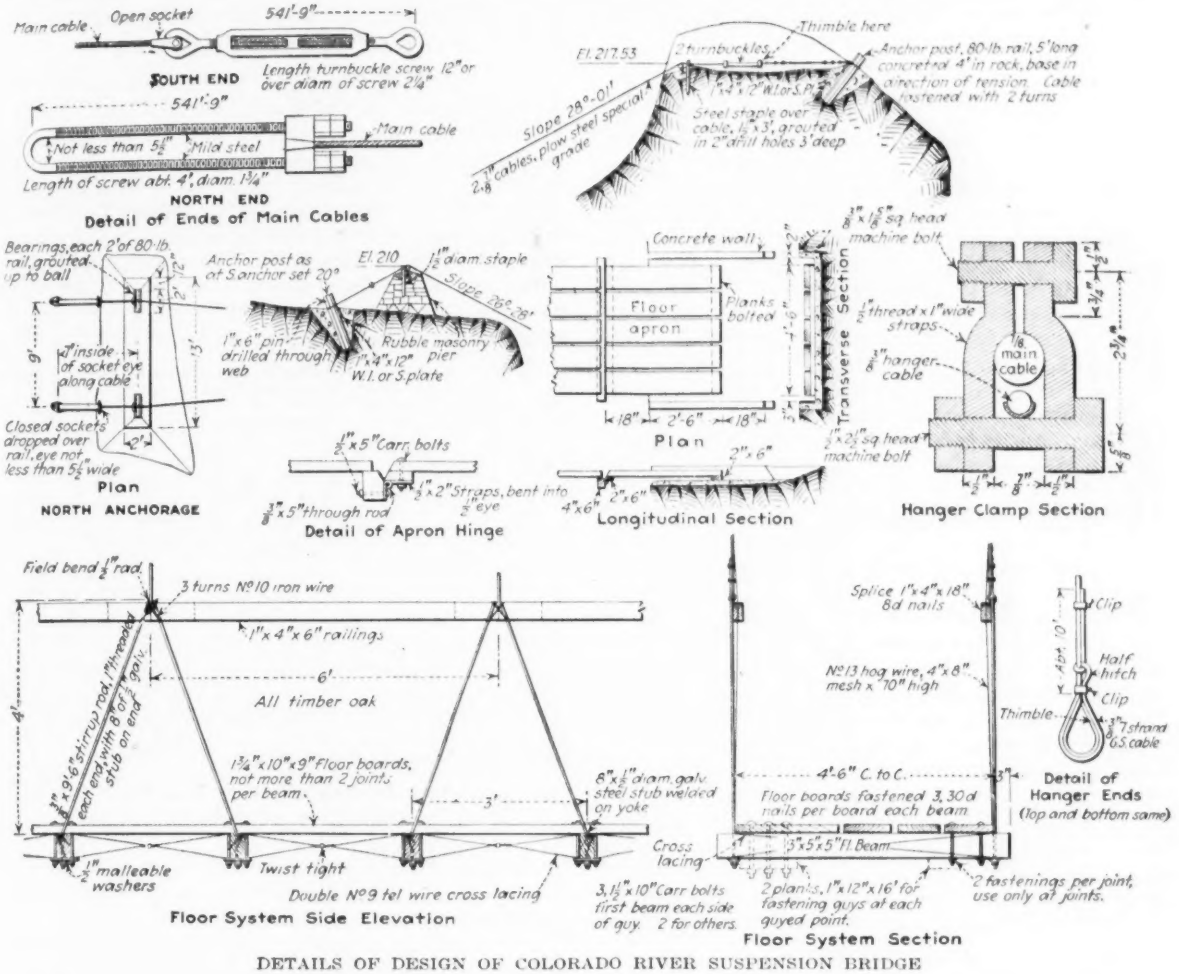


Plan



Elevation

PLAN AND ELEVATION OF BRIGHT ANGEL SUSPENSION BRIDGE ACROSS COLORADO RIVER IN GRAND CANYON


Main cable
Open socket
541'-9"
SOUTH END
Length turnbuckle screw 12" or over diam. of screw 2¼"
Not less than 5½"
Mild steel
Main cable
Length of screw abt. 4', diam. 1¾"
NORTH END
Detail of Ends of Main Cables
Thimble here
El. 217.53
2 turnbuckles
Anchor post, 80-lb. rail, 5' long concreted 4' in rock, base in direction of tension. Cable fastened with 2 turns
Slope 29°-0'
2-⅞" cables, plow steel special grade
Steel staple over cable, ½"x3", grouted in 2" drill holes 3' deep
Bearings, each 2' of 80-lb. rail, grouted up to ball
Anchor post as at S. anchor set 20°
El. 210
1" diam. staple
Slope 26°-26'
1"x6" pin drilled through web
Rubble masonry
1"x4"x12" pier W.I. or S. plate
7" inside of socket eye along cable
Closed sockets dropped over rail, eye not less than 5½" wide
Plan
NORTH ANCHORAGE
Concrete wall
Floor
apron
Planks bolted
Transverse Section
Plan
⅞"x1⅝" sq. head machine bolt
½"thread x 1" wide straps
⅞" hanger cable
⅞" main cable
¾"x2½" sq. head machine bolt
Hanger Clamp Section
1"x5" Carr bolts
½"x2" Straps, bent into ½" eye
⅞"x5" through rod
Detail of Apron Hinge
2"x6"
4"x6"
Longitudinal Section
Field bend ½" rad.
3 turns No 10 iron wire
1"x4"x6" railings
6'
All timber oak
⅝"x9'6" stirrup rod, 1" threaded each end with 8" of ½" galv. stub on end
1¾"x10"x9" Floor boards, not more than 2 joints per beam
3'
⅞"x½" diam. galv. steel stub welded on yoke
½" malleable washers
Twist tight
Double No 9 tel wire cross lacing
Floor System Side Elevation
Splice 1"x4"x18" 8d nails
No 13 hog wire, 4" x 8" mesh x 70" high
4'-6" C. to C.
Floor boards fastened 3, 30 d nails per board each beam
Cross lacing
5"x5"x5" Fl. Beam
3, 1½"x10" Carr bolts first beam each side of guy. 2 for others.
2 planks, 1"x12"x16' for fastening guys at each guyed point.
2 fastenings per joint, use only at joints.
Floor System Section
Clip
Half hitch
Clip
Thimble
⅜" 7 strand G.S. cable
Detail of Hanger Ends
(top and bottom same)

DETAILS OF DESIGN OF COLORADO RIVER SUSPENSION BRIDGE

precipitous sides about 400 ft. apart. There is located here at present a two-line cable which has been used for a tramway crossing. The trail on either side of the river at present, however, is not easily traveled nor is there any way of reaching the bridge on either side except by the excavation of a new trail along the rock side of the bluff. The floor of the bridge is located at a height about 13 ft. above the highest known water and 60 ft. above normal water.

The bridge itself is a wire cable suspension bridge with approximately 500 ft. span from center to center of bearings, and about 420 ft. along the roadway. It has two main ¾-in. plow-steel cables, placed approximately 10 ft. apart, anchored about 80 ft. above the floor level on the sides of the rock canyon. These cables carry the wood floor by ⅜-in. galvanized-steel cables spaced 6 ft. center to center, through the medium of spread iron rods 4 ft. deep.

The hangers are clamped to the main cables by bolted clamps, shown in the detail herewith, on the bottom bolt of which the hanger cable is looped with a clip and half-hitch connection as shown. A similar loop at the bottom of the hanger carries the inverted V-shaped ⅞-in. steel rods which are bent at the bottom to pass through the wooden floor beams. The floor itself is composed of 3 x 5 in. floor beams with 1¾-in. floor plank laid longitudinally fastened to the beams with 30 d. nails. In addition the floors are held down at the ends of the floor-beams with clamp fastenings as shown. These floor-beams are crossbraced by twisted No. 9 telephone wire as transverse X-bracing. In addition the bridge is stiffened by being guyed back to the rock face with ½-in. galvanized steel cables. As a protection for the passing animals and pedestrians, 4 x 8-in. mesh No. 13 hog wire 7 ft. high is attached along the sides of the inverted V iron-rod hangers.

The main suspension cables are ¾ in. diameter plow steel extra galvanized special span wire, having a strength of approximately 90,000 lb. The two anchorages are designed differently on account of the difference in rock condition and exigencies of construction. On the south side, from which the construction will be started, a trough is excavated out of the rock and the cable anchored around a diagonal anchor post made up of 50 ft. 80 lb. rail concreted 4 ft. into the rock base. Turnbuckles are provided for adjustment between this anchorage and the bearing which is formed of 80-lb. old rail concreted into the rock up to the road. The cable is further held in place by staples grouted into the rock. On the north side the anchorage is a similar diagonally placed rail, but the cable passes over a mound of rubble masonry with the bearings made up of two 80-lb. rails grouted up to the head. At this end the closed sockets form a fixed anchorage.

Expansion in the floor is provided at either end by an apron, as in the detail shown on the drawing, with

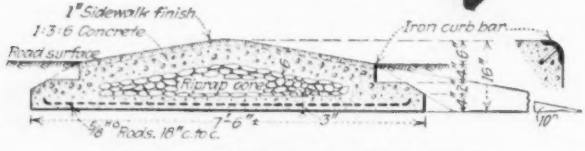
an extension apron reaching out from the concreted trail which runs along the side of the bluff.

It was necessary in the design to have the units of such size and weight that they could be packed by mules on the trail. The main cables weigh at least 700 or 800 lb., so it will be necessary to divide them into four pairs of coils, one pair being placed on each of the four mules in the train with an intervening length of cable about 20 to 30 ft. Each mule will be in charge of a packer and the intermediate men will in addition to leading the mules control the slack of about 20 to 30 ft. of cable so that they can successfully negotiate the switchback in the trail. There will be in all about 15 tons of material to take down to the site, which, as stated, is some 10 miles from the head of the trail. About 150 lb. per animal can be allowed, which means about 200 mule trips. Pack trains go down with from twelve to fourteen head of mules.

The packing as well as the material for the concrete will be furnished by the government. All the other material and the work itself will be done by the Monarch Engineering Co., of Denver, to whom a contract has been awarded. The bridge is designed by George C. Goodwin of the National Park Service, and the construction will be supervised by D. L. Reaburn, who is superintendent of the Grand Canyon National Park, also an engineer of long experience. It is expected the bridge will cost in the neighborhood of $13,000 and will be in service before the end of 1921 summer season.

Highway Humps at Railway Crossings

REDUCTION of accidents by providing humps in highway approaches to railway crossings at grade is contemplated by a bill which will be introduced this winter in the Tennessee Legislature. The proposed legislation, which has been initiated by the Nashville, Chattanooga & St. Louis Ry., specifies the construction and location; includes a requirement for sign posts, makes unlawful the use of X-signs for other purposes than to denote railway track; and places the obligation

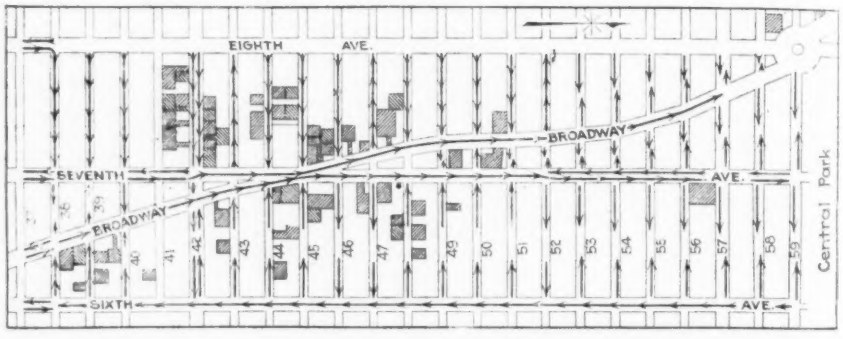


GROSS-SECTION OF PROPOSED HUMP

and cost of hump construction on the state and county highway departments. A concrete hump designed according to the law is illustrated by the sketch. This hump must be placed between 50 and 100 ft. from the track center on each side of the crossing and must extend the full width of the roadway. The time limit for the construction of humps is 90 days, with an extension, in extreme instance, to 18 months. The hump design illustrated is suggested by Hunter McDonald, chief engineer, Nashville, Chattanooga & St. Louis Ry.

Traffic Regulations Make Broadway a One-Way Street

IN AN EFFORT to expedite the movement of vehicles in the theater zone of New York City the Police Department, through Dr. John A. Harriss, special deputy commissioner in charge of traffic, has put into effect radical traffic regulations which make Broadway and other streets one-way thoroughfares from 7 p.m. until midnight, daily, except Sundays, and between the hours of 1 and 6 p.m. on Saturdays. The accompanying map, on which the principal theaters are shown by cross-hatching, indicates by means of arrows the direction which traffic must take between the hours noted. The new regulation became effective Jan. 5 of this year.



HOW VEHICULAR TRAFFIC MOVES IN NEW YORK CITY'S THEATER ZONE DURING EVENING HOURS
Theaters are indicated by cross-watching.

Traffic is permitted to move in both directions on Broadway north of 57th Street.

Parking of vehicles on any thoroughfare included in the territory bounded by 59th St., Sixth Ave., 37th St. and Eighth Ave., inclusive, is prohibited.

The territory contained in the above boundaries is known as the "east theater zone" and the "west theater zone," respectively, Broadway being the dividing line.

Vehicles conveying patrons to theaters in the east zone are permitted to park on the same street on which a theater is situated, east of Sixth Ave. Those conveying patrons to theaters in the west zone are permitted to park on the same street on which a theater is situated, west of Eighth Ave.

Sight-seeing vehicles are prohibited from standing on any thoroughfare within the above zones, except for the purpose of loading and unloading passengers, and then not to exceed a period of 15 minutes. Sight-seeing vehicles are prohibited from "cruising" on any thoroughfare within the theater zones.

The foregoing regulations do not apply to the following vehicles: United States mail, police, fire, fire patrol, bureau of buildings, emergency repair of public service corporations, ambulances, military, and those which run only on rails or tracks.

Imports and Exports During 1920

According to a recent bulletin issued by the Bureau of Foreign and Domestic Commerce the exports of the United States in the calendar year 1920 were $8,228,000,000, an increase of 4 per cent over those of 1919 and three and one-third times the exports during the calendar year 1913. Imports in 1920 amounted to $5,279,000,000 a 35 per cent increase over the calendar year 1919.

Proposed Code of Ethics for Contractors

Submitted at New Orleans Convention for Consideration of the Members of the Associated General Contractors

AT THE New Orleans convention of the Associated General Contractors, Jan. 25, the committee on ethics submitted a tentative draft of a code of ethics or practice for criticism of the members, with the expectation when perfected of recommending it for adoption by the association. The code defines certain *unprofessional* practices, sets up certain standards, and provides machinery for its enforcement.

The tentative draft on which criticism has been invited, is as follows:

Article I—Purpose

The purpose of the code is to define briefly the rules of professional conduct and ethics for the members of The Associated General Contractors of America.

Article II—Improper Practice

It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of The Associated General Contractors of America

1. To act for his clients in professional matters otherwise than as a faithful agent or trustee, or to accept any remuneration other than (a) that stipulated in the contract or (b) his customary charges for similar professional services to other clients.

2. To attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects, or business of another general contractor.

4. To alter a prepared bid after being informed of the bid of a competitor.

4. To lend his name to any questionable enterprise.

5. To engage in any movement which is obviously contrary to law or public welfare.

6. To engage in undignified, sensational or misleading advertising.

7. To submit bids on a basis other than that requested unless a bid on the basis requested is submitted for comparative or other purposes.

8. To accept a contract at the price submitted by the lowest but disqualified competitive bidder.

9. To seek information concerning the bid of a competitor and make use of the knowledge thus obtained for his own gain or for the competitor's detriment.

10. To collect money for making an estimate, where plans for securing payment for estimating are in force, without the knowledge of the owner or his representative.

Article III—Skill, Integrity and Responsibility

"Skill, Integrity and Responsibility," our slogan, requires

1. That in all their relations, our members shall be guided by the highest principles of honor.

2. That the dignity of the construction industry be upheld to the public at all times and its members protected against misrepresentation.

3. That a personal helpfulness and fraternity be maintained among our members and toward the profession generally.

4. That sensationalism, exaggeration and unwarranted statements be avoided and discouraged.

5. That clients be frankly advised when projects are undertaken which our members from former experience have found to be unprofitable.

6. Conservatism in all estimates, reports, testimony, etc., especially in connection with the promotion of business enterprises.

7. That when one of our members undertakes for a client work in connection with which he may make improvements, inventions, plans, designs or other records, he shall preferably enter into a written agreement regarding their ownership.

8. That a member cannot honorably accept remuneration, financial or otherwise, from more than one interested party. "No man can serve two masters."

9. That when a member is called upon to decide on the use of inventions, equipment, methods, etc., in which he has a financial interest, he should make his status in the matter clearly understood before engagement.

10. That credit be given where credit is due.

11. That where bids are requested an effort should be made to have them opened publicly at a specified time and place, known to all bidders.

12. That bona fide bids carefully prepared be submitted whenever solicited or the reasons for the inability or unwillingness to comply be stated—frankness in these matters will establish the obviously fair principle that all solicited bids are entitled to consideration and the bid thus solicited which is most favorable to the owner should be accepted.

13. That consistent pressure be exerted to have all bidders notified whenever it is the intention to request bids for the same or part of the same work from both subcontractors and general contractors.

14. That when a limited number of general contractors are requested to bid, the names of those invited to bid should be made known to all those who are so invited.

15. That all general contractors expose without fear or favor before the proper tribunals, corrupt or dishonest conduct in the profession and accept without hesitation employment against a member who has wronged his client.

16. That where perjury concerning professional matters is indulged in, the matter be publicly brought to the attention of the prosecuting authorities.

17. That all members guard the association against the admission to its membership of candidates unfit or unqualified because deficient in either moral character or professional ability.

18. That competitors and their work be treated with fairness whenever clients discuss them with general contractors.

19. That all work be so creditably performed that the seal of the Association will continue to symbolize the highest professional ideals.

20. That when any member is charged publicly with using questionable methods, he should voluntarily present all facts to the Committee on Ethics.

21. That the honor of every member be defended when wrongfully accused.

22. That all fraudulent misrepresentations be exposed as a duty to the public and the profession.

23. That work shall not be contracted for at less than cost with the hope or intention of finding enough "extras" to take care of the profit.

24. That existing agreements between general contractors and labor, architects, engineers or others be respected whenever work is done in the locality affected by said agreements. Should extenuating circumstances prevent adherence to these agreements the general contractor should confer with the general contractors who are parties to the local agreements, in order to work out the best substitute or else he should publicly announce his intention to disregard the agreements, and give his reasons for so doing.

25. That general contractors work loyally for the success of measures brought forward to benefit their industry, regardless of their immediate interest or lack of interest in such measures.

26. That the public welfare be promoted at all times and particularly in matters in which the general contractors' experience qualify them to act; giving freely of their counsel and support and holding themselves in readiness to assume responsibilities when called upon, bearing in mind that the public welfare is paramount and that the cus-

tomary villification practiced by those who have been thwarted in controlling such matters or finding berths for henchmen has no effect upon any unbiased mind.

ARTICLE IV—OWNER OR CLIENT

The proper relationship of the general contractor to the owner (or client) requires:

1. That no contract should be undertaken which the contractor is unable economically and efficiently to complete.

2. That the owner be intelligently advised of all things which may promote his interests in the successful prosecution of the project.

3. That advice should not be given to owners on subjects concerning which the general contractor is not qualified to advise.

4. That controversies with owners concerning compensation are to be avoided so far as shall be compatible with self-respect and with his right to receive his contractual or reasonable compensation for his services; and lawsuits with owners should be resorted to only to prevent injustice, imposition or fraud.

5. That members keep constantly in mind that the results of their labor are permanent assets, having a definite economic and taxable value, in contradistinction to consumable or materialistic products, and that laxity in execution may in after years reflect discredit on the profession.

ARTICLE V—ADMINISTRATION

1. Administration of this code of ethics shall be performed by a Committee on Ethics consisting of five members appointed by the president holding office at the time of the adoption of the code. One committee member shall be appointed for five years, another for four years, another for three years, another for two years, another for one year, and thereafter, the President then holding office shall appoint one member annually to serve for five years and also fill such vacancies as may occur for an unexpired term. All of these members shall be over forty years of age. The committee shall select its own chairman. The Committee on Ethics shall investigate all complaints submitted to it bearing upon the professional conduct of any member, and after a fair opportunity to be heard has been given to the member involved, shall report its findings to the executive board, whose action shall be final.

2. Discipline for violation of this code shall be determined by the executive board, after the facts have been reported by the Committee on Ethics.

Or

(The following paragraph is submitted as an alternative.)

2. Upon specific complaint made by or through one member against another, of violation of the code of ethics, such complaint shall be referred to the Committee on Ethics, which shall promptly give the complaint full and fair investigation in such manner as it shall deem proper, save that the accused must be given an opportunity to be heard in his own defense. The findings of the Committee on Ethics shall be transmitted to the executive board for action. If the accused member is found guilty of the charges preferred it is the duty of the executive board to discipline him, either by censure, suspension for a period not to exceed one year, fine not to exceed Two Hundred ($200.00) Dollars, or expulsion; the action of the executive board to be final and its action published or otherwise to be brought officially to the notice of all members.

ARTICLE VI—AMENDMENTS

Upon thirty (30) days' notice stating the change proposed, this code of ethics may be amended by a two-thirds vote of the entire executive board or by a majority vote of the association voting in convention or by letter ballot.

Density of Road Bridges in New Jersey

On the state road system of New Jersey, the number of miles of road per bridge varies from ½ on route 16 to 8.1 on route 14.

A Further Study in the Economics of Garbage Reduction

Operations at Columbus and Washington Compared —Outlay for More Tankage at Washington Would Pay But Not for Grease

BY F. S. BESSON

Major, Corps of Engineers, U. S. A., Assistant to the Engineer Commissioner of the District of Columbia

VALUABLE deductions may be drawn from the garbage reduction records of Columbus, Ohio, and Washington, D. C. The details of nine years' operation of the Columbus works were given in an article by James W. Follin in *Engineering News-Record*, Nov. 18, 1920, p. 991. Results at Washington for the fiscal year 1919-20 were reviewed by the present writer in the same journal for Dec. 2, 1920, p. 1072. This article will compare some of the Columbus and Washington figures and will show that the Washington plant, which is old and not up to date, might advantageously be made to produce more revenue from tankage but that under existing conditions, including the low price of grease, the installation of a percolator to recover additional grease would cost more for capital, coal and gasoline than the added grease would be worth.

It is not unusual for garbage samples to show 75 per cent moisture content, 5 per cent ether extract and a residue of 20 per cent. Based undoubtedly on such tests are those reports of engineers that assume a production of 4½ per cent grease and 20 per cent tankage from the reduction of city garbage. The average selling prices shown during a year by Columbus and Washington are 8.2 c. per pound for grease and $13.90 per ton for tankage. Based upon a production of 4½ per cent grease and 20 per cent tankage these prices would give $10.16 as the value of a ton of green garbage. Such an estimate of the value of a ton of garbage has led to much disappointment and has discredited many reduction systems.

Following are listed for comparison the important figures relating to Columbus and Washington:

COMPARISON OF THE COLUMBUS REDUCTION PLANT WITH THAT OF WASHINGTON, D. C.

	Columbus	Washington
1. Population	237,000	437,500
2. Tons garbage collected per year	18,126	52,800
3. Pounds per capita	153	241
4. Average tons reduced per day (year of 313 days)	58	169
5. Average tons reduced per day (max. month)	80	234
6. Average tons reduced per day (min. month)	42	136
7. Tons grease extracted	352	927
8. Per cent grease extracted	1.942	1.76
9. Value of grease per 100 lb.	$6.729	$9.7
10. Total value of grease	$47,372.00	$179,668.00
11. Tons tankage produced	1,558	3,048
12. Per cent tankage produced	8.6	5.8
13. Value of tankage per ton	$15.65	$12.11
14. Total value of tankage	$24,336.00	$36,922.00
15. Total value of production	$73,248.00	$216,590.00
16. Value of production per ton of garbage	$4.05	$4.10
17. Tons of fuel consumed per ton of garbage	0.378	0.091
18. Cost of one ton of fuel	$2.87	$6.64
19. Gallons of gasoline consumed per ton of garbage	1.647	No percolation
20. Cost of labor for reduction	$37,703.00	$95,000.00
21. Per ton cost of labor	$2.08	$1.79
22. Total cost of plant operation	$106,438.00	$176,100.00
23. Per ton cost of operation	$5.87	$3.33
24. Plant charges	$19,216.00	$13,000.00
25. Per ton plant charges	$1.06	$0.25
26. Total reduction cost	$125,654.00	$189,100.00
27. Total per ton reduction cost	$6.93	$3.58
28. Status (receipts—costs)	—$52,406.00	+$27,490.00
29. Per ton status	—$2.89	+$0.52
30. Per capita status	—$0.22	+$0.06

Item 8 of the table gives a grease extraction for one city of 1.942 per cent and for the other 1.76 per cent. Item 12 shows tankage percentages of 8.6 and 5.8, and the per ton values of green garbage are shown by item 16 to be $4.05 and $4.10. These figures, taken from practical operating data, are far from the theoretical

ones of 4½ per cent grease, 20 per cent tankage and $10.16 per ton value of green garbage. A recovery of $10.16 may be obtainable but its economy is a matter of relative expenditures and receipts. For instance, it may be noted from item 17 that Columbus used four times as much coal per ton of garbage as did Washington and, in addition, used 1.647 gal of gasoline solvent per ton of garbage, whereas Washington used no solvent. As for coal, it may readily be seen that Columbus with a cost of $2.87 could afford to expend more coal in an effort to increase production than could Washington with a cost of $6.64 per ton.

The salvage from Washington's garbage of but 5.8 per cent tankage and 1.76 per cent grease is very low. With the assistance of Mr. Hacker, supervisor of city refuse, and Mr. Crane, superintendent of the Reduction Plant, a study has been made as to possible increases in these items. It is estimated that a mill for grinding tailings and that settling basins for recovering sediment in tank water would increase the tankage to about 11 per cent of the amount of green garbage; of which increase about two-thirds would be due to grinding and one-third to recovery of the sediment. The value, however, of the sediment is several times that of ground tankage and the average value would be increased from about $12 to $14 per ton, so that on a basis of 52,800 tons of garbage there would be produced 5,808 tons of tankage worth $81,312. No increase in labor cost would be entailed, as at present considerable labor is required to get rid of the tailings which are now wasted. The cost of the equipment required for grinding tankage and recovering the stick would be as follows:

1—9-ft. diam. dry pan mill installed	$3,750
1—100-hp. engine for driving mill, dryer and conveyors	3,000
Necessary shafting, bearings, conveyors, belting, etc.	750
Building for mill	2,500
Magnetic separator	3,000
Settling basins for recovering the stick	10,000
Total	$23,000

The cost of operation would be as follows:

6 per cent interest on $23,000	$1,380
10 per cent depreciation on $23,000	2,300
750 tons coal at $9	6,750
General supplies	3,600
Total	$14,030

Increase in receipts from tankage:

$81,312 — $36,922 (present receipts)	$44,390
Expenses as above	14,030
Profit from mill and stick	$30,360

It thus appears that an investment for increasing tankage as described would be one of the best that could be made. The use of evaporating pans would recover a much higher percentage of stick from the tank water than can be obtained by the use of settling basins but the value of the fuel used would exceed that of the product obtained.

An essential difference in the Columbus and Washington plants lies in the fact that the former percolates its press cake; that is, uses gasoline as a solvent in order to extract a maximum of grease, while the latter makes no use of solvent. At today's writing, with coal in the District of Columbia above $10 per ton, gasoline above 25 c. per gallon, and grease selling for less than 3 c. a pound, it is manifest that much discretion must be exercised in any attempt to increase production. However, it should be realized that less than 3 c. per pound for grease is an abnormally low figure. In the long run there is a rather definite relationship between commodity prices. With labor wages as at present, coal estimated at $9 per ton, and gasoline at 25 c. per gallon, 7 c. per pound is a conservative value to place on grease.

The installation and operation of a percolation plant may accordingly be estimated as follows:

Equipment:	
2 Percolators, approx. 9 ft. diam. x 19 ft. long, installed	$16,000
1 Direct heat dryer, 4 ft., 9 in. diam. x 32 ft. long, installed	10,000
1 Stoker for dryer furnace, installed	2,000
2 Gasoline storage tanks, installed	1,600
2 Condensers, 4' x 8 x 38 ft., installed	4,000
2 Vaporizing and treating tanks, 6 x 26 ft., installed	2,000
1 Gasoline separating tank, 6 x 20 ft., installed	1,000
2 Grease storage tanks, 10 x 20 ft., installed	2,400
3—150-hp. return tubular boilers, installed	15,000
3 Stokers for above boilers, installed	6,000
1 Engine for driving percolator, dryer, conveyors, etc.	5,000
3 Pumps for gasoline, treating and grease, installed	2,000
Shafting, piping, valves, conveyors, belting, pulleys, hangers, etc.	10,000
1 Tankage, storage bin	5,000
Percolator building	15,000
Dryer building	10,000
Boiler house	7,000
Coal unloading equipment	5,000
Sundries	6,000
Total equipment	$125,000
Labor, operation:	
1 Foreman percolating plant	$1,450
1 Fireman boiler house	1,650
2 Fireman boiler house (night)	2,600
1 Fireman dry house	1,450
1 Engineer	1,650
8 Skilled laborers	10,400
Total labor	$19,200
Supplies:	
4,840 tons coal at $9 per ton, delivered	$43,560
79,200 gal. gasoline at $0.25	19,800
Miscellaneous	15,000
Total supplies	$78,360
Operating account:	
Interest on investment—5 per cent on $125,000	$6,250
Depreciation, 10 per cent on $125,000	12,500
Labor	19,200
Supplies	78,360
Total expenses	$116,310
Receipts, 1 per cent grease—(528 tons) at $140	73,920
Loss on operation of percolating plant	$42,39

The remarkable point to be noted in the above estimate is that, not considering the plant and equipment necessary for percolation nor the labor necessary for working out the grease, it is shown that the value of the supplies used exceeds that of the grease obtained. Furthermore, the supplies used consist mostly of coal and gasoline, two items of much importance today. It is obviously poor policy to exchange coal and gasoline for an equivalent value of grease for which, at the best, it is difficult to obtain a market.

A prime essential in the disposal of the garbage of a municipality is to give satisfactory service to the citizens. Probable profits from by-products of the disposal, while commanding regard, should be of secondary consideration. Entirely satisfactory results can be obtained only when it is realized fully by the public that getting rid of the garbage of a city is a function in a class with the disposal of its sewage. If this had been realized years ago, the history of the garbage disposal in the first cities of the land would have shown fewer failures and less disappointment.

Machine Tamped Base for Brick Pavement

A machine tamped base is required for monolithic brick pavement by the 1921 specifications of the Kansas Highway Commission. At least three trips of the tamping machine are required and it is specified that the tamped surface "shall show sufficient surplus of mortar to produce adherence between the bottom surface of the brick and the concrete base." The bricks are laid directly on the tamped base. Experiment last year with this type of construction was described in *Engineering News-Record* Jan. 6, 1921, p. 27.

Concrete Oil Reservoir with Flat-Slab Roof and Floor

In Order to Insure Strength and Tightness Concrete for Tanks at Three Rivers, Que., Is Mixed by Weight —Special Joints for Expansion

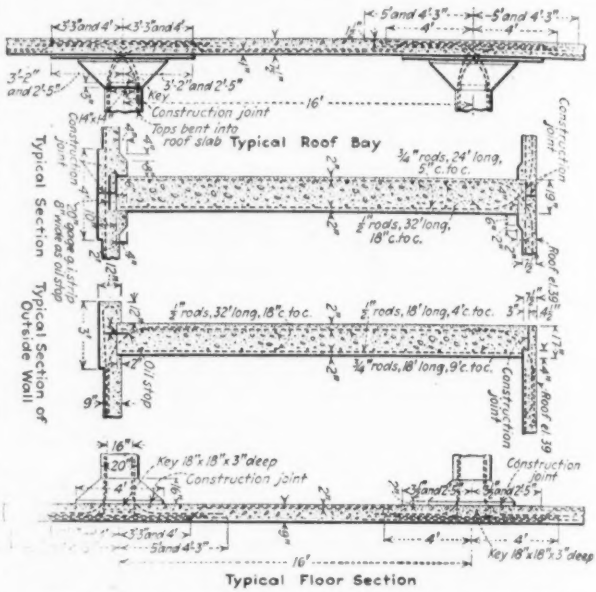
BY EUGENE E. HALMOS
Designing Engineer, Parsons, Klapp, Brinckerhoff & Douglas, Consulting Engineers, New York City

ONE of the largest reinforced-concrete underground fuel-oil reservoirs in existence was built at Three Rivers, Que., last summer for the St. Maurice Lumber Co. The structure is approximately rectangular in plan with girderless roof slabs supported on columns resting on a similarly designed floor slab and with sides reinforced to resist earth pressure from without and oil within. The connections of the walls to roof and slab were detailed so as to take care of movements due to temperature or to filling and unfilling. A special feature in construction was the proportioning of the concrete by weight in a semi-automatic device in order to insure a uniformly strong concrete.

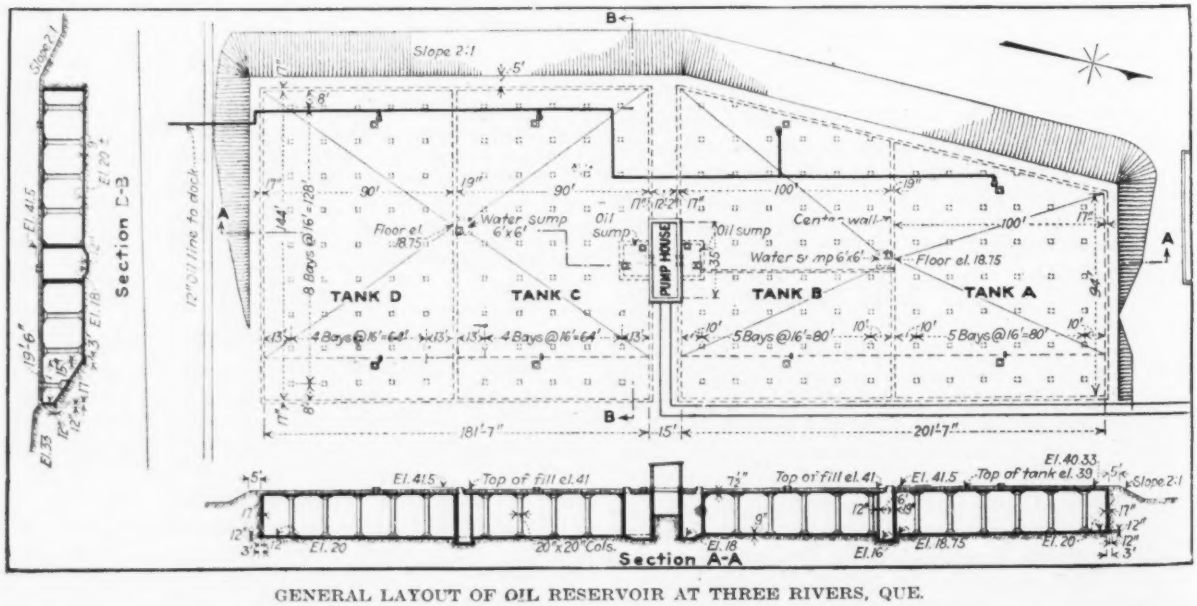
The plant is located between the St. Maurice and St. Lawrence Rivers near their junction, on a peninsula forming a plateau about 45 ft. above low water, having a rather steep slope toward the St. Maurice River, and a gentler slope toward the St. Lawrence. The whole peninsula is of alluvial sand peculiar to the rolling country adjacent to the north shore of the St. Lawrence River. This sand hill was excavated to receive the oil reservoir here described.

The reservoir has a capacity of about 160,000 bbl. and is intended to store fuel for use in the operation of the company's new paper mill which is now under construction. The tankers land at the company's dock about 400 ft. from the reservoir into which the oil is pumped by the ship's pumps through a 12-in. pipe at a temperature of from 120 deg. to 150 deg. F. depending on the season of the year. The boilers of the paper mill will be supplied with fuel from a service tank into which the oil stored in the reservoir will be pumped at the rate needed.

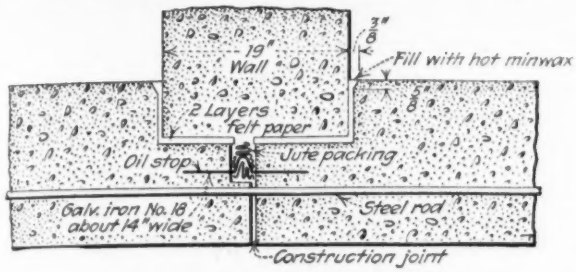
The main plan herewith shows the general plan of the reservoir, which consists of two sets of twin tanks and a centrally located pump house. One oil sump and one water sump are provided for each set of tanks. These sumps are supplied with the necessary piping and valves to permit both oil and residual water to be pumped from each tank, independently.



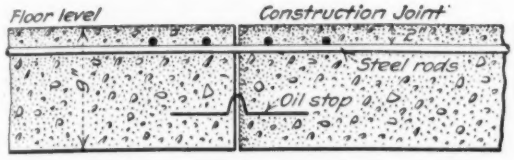
DETAILS OF FLOOR, ROOF AND COLUMN AND WALL CONNECTIONS



GENERAL LAYOUT OF OIL RESERVOIR AT THREE RIVERS, QUE.



Oil Stop at Bottom of Wall



Oil Stop at Construction Joint

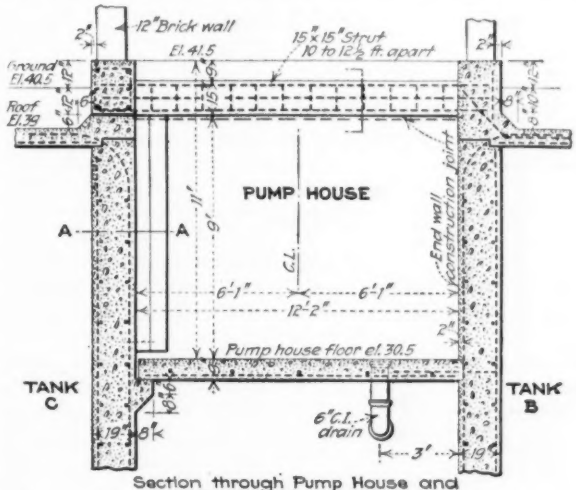
DETAILS OF OIL STOPS

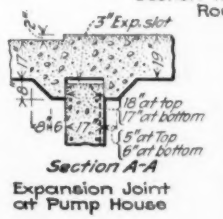
It will be noted that the structure is comparatively shallow and consequently has a large superficial area; also, that the floor along the east wall is built on a slope of 1 on 1½, and that, while tanks *C* and *D* are rectangular in plan, tanks *A* and *B* are trapezoidal. These features were adopted after a study made with a view to produce the required capacity with the least expense and with due regard to conditions determined by the elevation of the ground water, by the limits of the company's property and by the necessity of harmonizing the reservoir layout with the present and proposed other structures of the plant.

The roof of the tanks is of the two-way drop panel flat-slab type and it is supported on square columns, the span being generally 16 ft. The roof is designed for a total load of 400 lb. per square foot, including the weight of the insulating earth fill and of a possible snow cover of 6 or 7 ft. The floor is practically an inverted replica of the roof except as to the omission of the drop panel; moreover, a slight slope is given to the floor toward the water sump for drainage, and that part near the east wall is constructed with an inclination 1 on 1½ as already mentioned.

The walls are treated as slabs hinged on the top and the bottom and are reinforced for the most unfavorable conditions of loading. They are placed in grooves formed in the floor slab permitting of a slight angular displacement which is expected to occur under the influence of the loads and the temperature variations. The top of the walls is tied to the roof by reinforcing bars. It will be noted that the walls are reinforced on both faces. This, of course, must be so at the interior walls which may receive unbalanced load from either side. At the exterior walls, the reinforcement on the inner face takes care of the active earth pressure when the tank is empty. When the tank is full with oil, the oil pressure on the inside is about twice as large as the active earth pressure on the outside. It was found by a close analysis that the elastic deformation of the wall under this load will not produce enough passive resistance in the surrounding fill to counterbalance the surpressure of the oil, and the outside face of the walls was correspondingly reinforced. A specially designed oil stop prevents leakage at the junction of the walls and the floor slab. Typical details are shown in the accompanying drawings.

No expansion joints were provided in any part of the roof and floor slabs nor in the walls, all structural parts being properly reinforced to safely take the stresses induced by the expected considerable temperature changes. Construction joints were made along lines of zero shear, and oilstops, similar to those at the bottom of the walls, were placed across these joints. The only expansion joint in the whole structure is at the pump house, the brick superstructure of which would seriously suffer due to the movement of the reservoir walls, upon the coping of which the house is built. This joint is formed in the following manner and is shown in one of the drawings. The coping under the south wall of the pump house is integral with the reservoir wall, while the coping under the north wall lies on a horizontal sliding joint. This latter coping is properly reinforced and rigidly connected by means of struts to the opposite solid coping. The cross walls under the east and west walls of the pump house can slide in vertical grooves



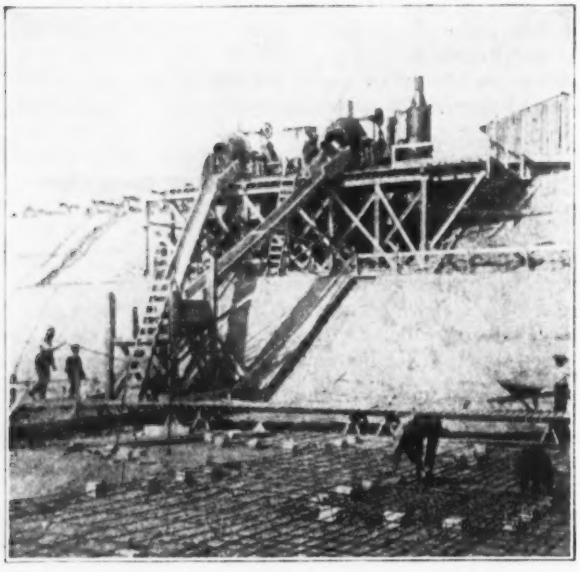


EXPANSION CONNECTIONS AT PUMP HOUSE WALLS AND ROOF

provided on the face of the south wall of tank *B*. It can be seen that through this arrangement both sets of tanks may expand or contract without affecting the pump-house superstructure.

By far the most important problem in the construction of the reservoir was properly to determine the concrete mix with the given aggregates. It was mandatory to use a minimum amount of cement, and to produce an oil-proof, non-porous concrete of high compressive strength, unaffected by a possible temperature variation of perhaps 100 deg. F. Additional importance to this matter was given by the requirement that each tank was expected to take oil not later than four weeks after its completion. A careful study of all conditions led to specifying a concrete having compressive strength of 3,000 lb. per square inch in twenty-eight days.

Nathan C. Johnson, of New York, was asked to advise on the subject of proper mix. He reported that the sand and the ballast available were clean and of



PLANT FOR WEIGHING AND MIXING CONCRETE AGGREGATES

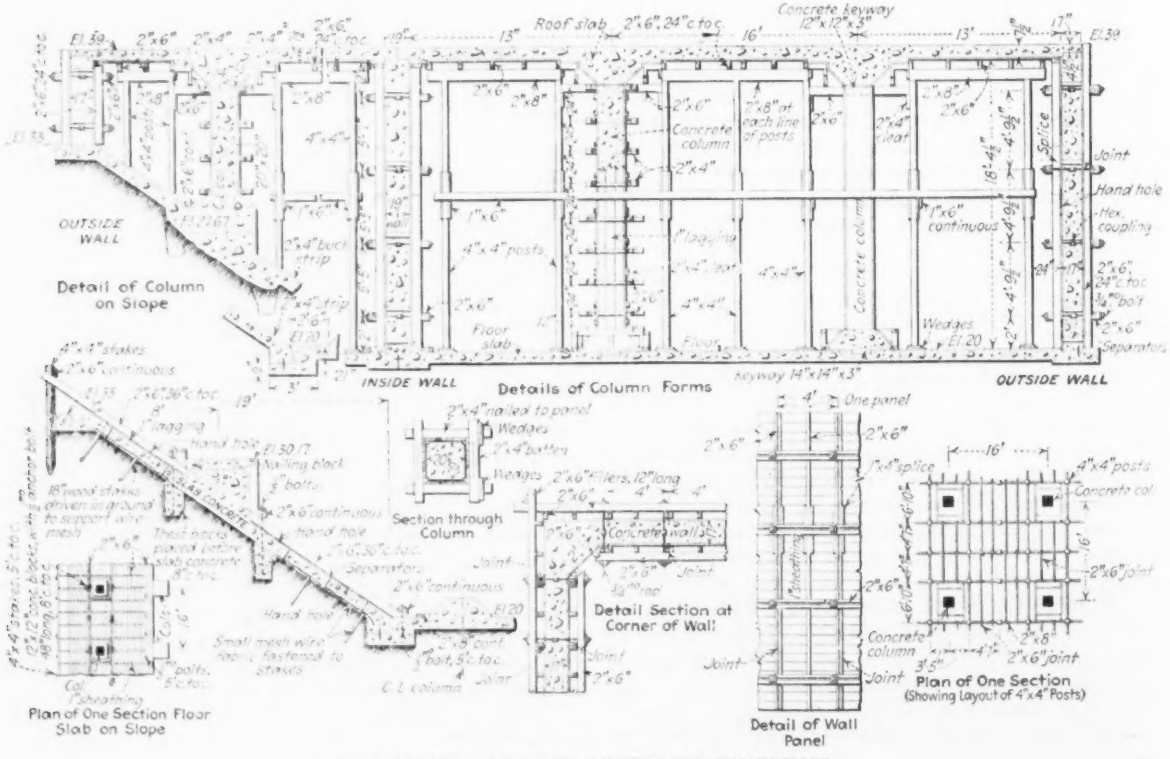
excellent quality but difficult of combination. The stone was coarse trap, only a small percentage of which would pass a 1½-in. ring, with sizes up to 4 in. occurring in patches. The sand, which was obtained from the excavation of the site, was very fine and of substantially two size grains, 32 per cent passing through No. 65 sieve and 95 per cent through No. 20 sieve. It was found that the surface area of the sand was 3,200 sq.ft. per 100 lb. weight. The volume of the sand varied considerably with varying moisture content and thus led to the decision of proportioning the aggregates by weight. A ½-cu.yd. batch consisted of 3 bags cement, sand weighing 5.04 bags and stone weighing 10.85 bags of cement; expressed in volume, the mix was substantially 1 : 1⅔ : 3. Considering the specified requirements and the character of the aggregate, a water ratio of 0.6 was recommended by Mr. Johnson. This mixture worked well and gave practically a full ½ cu.yd. yield.

The concreting plant consisted of two batch mixers, one electrically and one steam operated, placed on a platform midway between the two sets of tanks, on the east side of the excavated slope and about 6 ft. above the elevation of the roof. The mix was then carried in chutes to the proper elevation for distribution by means of hand carts. The stone and sand bins were located behind the mixers.

Counterbalanced weighing hoppers were provided under the sand and stone bin gates and by means of these the side loader slips were charged with definite and unvarying quantities of the aggregate. With a fixed and constant quantity of cement, sand, stone and water entering into each batch, the consistency chosen became automatically duplicated throughout all the batches from both mixers. With careful placing, this certainly found reflection in smooth castings, free from laitance or honey comb, giving each section as poured a true tightness and a true monolithic character not often found.

Furthermore, since the composition and character of the concrete was thus made dependable, forms could safely be pulled at a definite and predetermined time and earlier than customary procedures would make permissible.

Samples made in the field, when tested in the laboratory, showed a compressive strength of 2,960 lb. per



FORMS USED IN THREE RIVERS OIL RESERVOIR

square inch in 28 days. To test the oil proofing quality of the concrete, a test box, 3 ft. cube, with side walls 9 in. thick, was poured on the first day of making concrete. This box, 30 days after pouring, was filled with oil and subjected for five days to a pressure equivalent to 27 ft. head or 50 per cent more than that possible in the reservoir. After the box was broken up, it showed no appreciable trace of permeation, so that the originally contemplated coating of the inside of the tanks with sodium silicate was abandoned as unnecessary.

Special Forms Used

On account of the short time available for the construction of the reservoir it was necessary to have the wall and roof forms ready in advance and of such design that they would be easily stripped and re-erected. A drawing herewith shows typical details of the forms indicating the method of sectional division and the connections used. The wales and joists were calculated with due regard to the progress of the predetermined daily work. No failure of forms of any sort occurred throughout the whole job.

Difficulty was expected at the concreting of the sloping tank bottoms along the east wall. It was feared that the rather loose sand subsoil would be dislocated during the placing of the concrete and make a poor job. To avoid this possibility, a mat of ½-in. wire mesh was placed on the slope and plastered with cement mortar. In this way a solid bottom was created and the slope could be poured without reducing the quality of the work at these places.

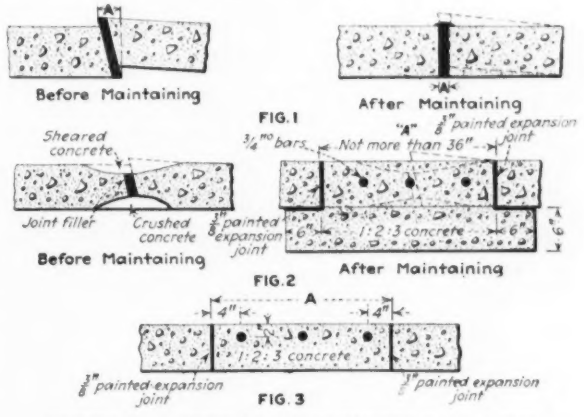
The reservoir was designed by the engineering staff of the International Paper Company, A. H. White, chief engineer, and the plans were reported upon by Parsons, Klapp, Brinckerhoff & Douglas, consulting engineers. The contract was awarded to the Parklap Construction Corporation, of New York, the construction organization of the consulting engineers. Work was executed under the direction of W. J. Douglas, president of the Parklap Construction Corporation. E. A. Little had charge in the field, F. A. Morgan assisting. The writer had charge of matters pertaining to the design and of the general supervision of the work. The contract was awarded on July 17, 1920, and tank *D* was filled on Oct. 4, 1920.

Curves of 10 Degrees Reduced to 1½ Degrees

Realignment which substituted one long curve of 1½ deg. for a series of sharp curves at the lower end of a four-mile tangent on a grade of 1.4 per cent has materially reduced maintenance expenses at this point, which is on the Southern Pacific Ry. between Chamiso and Benson, Arizona. In the original location across the San Pedro valley, curves were used freely to avoid heavy cuts and fills in a dry sandy clay which is subjected to rapid erosion by the heavy rains. In a stretch of 1.3 miles of line there were four curves of 10 deg., one of 6 deg. and one of 2½ deg. compounded to 9 deg., the total curvature amounting to 388 deg. 22 min. There were also three pile trestles with a total length of 32 ft. In the new location the total curvature is only 139 deg. 47 min. About 123,000 cu.yd. of grading were required for the relocation, two concrete arch culverts and some concrete pipe culverts.

Replacing Concrete Slabs at Joints

IMPERFECT, heaved, sheared or crushed slabs at joints in concrete pavement are successfully repaired in Pennsylvania by the methods indicated by the three accompanying sketches. (1) Heaving or riding of the slab due to improper placing of the bituminous joint filler is repaired, when *A* does not exceed 2 in., by cutting out the joint with a cold chisel and refilling the opening with joint filler and coarse sand or ⅜-in. stone. (2) Concrete crushed or sheared because of the use of short or narrow bituminous strips of joint filler, is



METHODS OF REPLACING CONCRETE PAVEMENT

repaired by cutting out the damaged part not exceeding 3 ft., constructing a sub-base slab and refilling the cut-out portion with concrete reinforced. (3) When the crushed or sheared section involves the replacement of more than 18 in. of each adjacent slab or wherever the pavement slab is cracked within 5 or 6 ft. of a high, heaved or imperfect joint, the section between cracks is removed, the slabs chiselled carefully and the section entirely replaced with new concrete. The standard slab is used in the replacement and is reinforced with round rods spaced on 12-in. centers.

Panama Canal Traffic Highest in 1920

TRAFFIC through the Panama Canal during 1920 reached a new high record. The commercial ships numbered 2,814, as compared with 2,478 during the fiscal year ending June 30, 1920, and 2,134 during the calendar year 1919. The gain was 13.56 per cent in ships over the fiscal year 1920 and 31.87 per cent over the calendar year 1919. The net tonnage of the commercial vessels in the calendar year 1920 aggregated 10,378,265 tons as compared with 8,546,044 net tons in the fiscal year 1920 and 6,919,149 net tons in the calendar year 1919. The gain was 21.44 per cent, over the fiscal year; and 50 per cent over the calendar year 1919. The tolls levied during the year aggregated $10,295,329.96, as compared with $8,513,933.15 in the fiscal year ended June 30, 1920, and $6,992,218.39 in the calendar year 1919. This was a gain of 20.92 per cent over the fiscal year 1920 and 47.24 per cent over the calendar year 1919. The cargo carried by commercial vessels aggregated 11,236,119 long tons. The cargo in the fiscal year 1920 was 9,374,499 tons, and in the calendar year 1919 it was 7,468,167 tons. The gain was 19.86 per cent over the fiscal year 1920, and 50.47 per cent over the calendar year 1919.

Pier of Dayton Arch Bridge Split and Listed

INVESTIGATIONS of the failure of the Third St. concrete arch bridge over the Miami River in Dayton, Ohio, have not yet brought to light the cause of the failure. As reported in our news pages of Jan. 27, p. 187, the failure of the bridge occurred abruptly, two automobiles and a pedestrian being thrown into the river. The vehicles may be seen in the view Fig. 2 herewith, which shows the condition of the up-stream or north end of the pier supporting the two spans involved in the failure, as is more generally shown in Fig. 1.

crete Steel Engineering Co., who designed the bridge and followed its construction closely. During the sixteen years of service of the bridge (it was built in 1904-1905) no weakness or trouble has developed, and the structure went through the catastrophal flood of 1913 without apparent injury, although its arches were flowing full and under head.

Channel improvement carried on by the Miami Conservancy District during the past two years has involved some widening and deepening of the river. However, Charles H. Paul, assistant chief engineer, advises us that no excavation has been made within 45 ft. of the pier in question, and no excavation under the bridge

FIG. 1. WRECKED ARCHES OF THIRD ST. BRIDGE OVER MIAMI RIVER, DAYTON, OHIO

The suddenness of the arch failure indicates that the failure of the pier below preceded, and subjected the arches above to excessive stress. The piers of this bridge are founded on gravel about 9 ft. below original river bottom, according to William Mueser of the Con-

within the limits of the two spans which failed. Soundings show depths ranging from below 712 to 714 in the channel, one span west, pier bottom being 713.13.

The pier between the two arches that failed is split vertically a little upstream of the longitudinal center line of the bridge, and the up-stream portion has moved about a foot up-stream and has listed to the north and west. The arches, of the Melan type, show a separation tending to follow longitudinal vertical planes, possibly construction joints. A large part of the face of one arch is formed by one of the reinforcing frames embedded in the concrete. The indications from the position of the pier and the wreckage is that the easterly arch failed in tension and dropped, while the westerly arch was crushed, when the pier broke in two and listed to the west. There is nothing to indicate how long a dangerous condition existed.

Harrington, Howard and Ash of Kansas City are conducting an investigation of the bridge for the city.

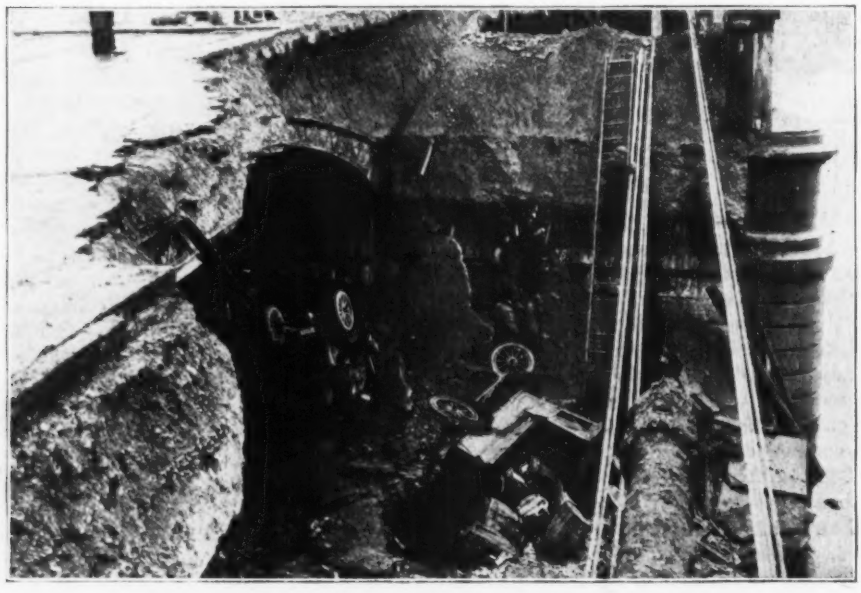


FIG. 2. UP-STREAM HALF OF PIER BROKEN AWAY
Note separation of arch concrete on line of reinforcing frame.

Inadequate Organization Policy Causes Hirst's Resignation

State Highway Engineer of Wisconsin Unwilling to Shoulder Heavy Responsibility with Underpaid Staff

AS ANNOUNCED *in the news section of this issue, A. R. Hirst, state highway engineer of Wisconsin, has tendered his resignation to take effect not later than Dec. 31 of this year and has issued to the people of Wisconsin a statement setting forth the reason for his action. It is, in brief, that he is not willing longer to assume the heavy responsibility of state highway engineer with the inadequate organization allowed under the narrow policy characteristic of public service in this country.*

Mr. Hirst's statement, in full, follows:

"THE filing of my resignation as state highway engineer, effective not later than Dec. 31 of this year, or earlier, at the pleasure of the State Highway Commission, has occasioned considerable comment and some speculation as to my reasons for taking the step, especially in view of the fact that the present salary attached to the position, $7,500 per annum, is one of the largest paid in the state service. It is only fair to those people of the state who have so loyally and freely supported our efforts for the betterment of highways in Wisconsin that I should at this time give some of the reasons for taking the step which has been announced.

"I wish to state at the outset that there is and has been nothing in my relations with the State Highway Commission, with any past or present state official, or with the present legislature, to impel me to resign. My personal and business relations with all of these persons and bodies have been of the pleasantest, and, I have every reason to believe, would so continue as long as I felt able to remain in the state service.

"It is nearly fourteen years since I entered the highway service of Wisconsin. In that time, under the impetus of the state-aid (1911) and federal-aid (1917) highway laws, the highway program in Wisconsin has reached tremendous proportions. There have been built 8,500 miles of all types of highway and 1,700 bridges at a total cost of $40,000,000. For the planning and execution of this work, I, as the chief engineer and executive officer of the State Highway Commission, have been personally responsible.

"For 1921 there is available a total of over $20,000,000. (Please note this total in comparison with the above total for 1912 to 1920 inclusive), for federal, state and county-aid construction of roads and bridges in Wisconsin, exclusive of the amounts available for strictly town, village and city construction. This sum will not and should not all be spent, because we are not organized to spend it properly, but probably well over 2,000 miles of all types of highway will be built. The years that have gone since 1907 have seen Wisconsin placed in the foremost rank as a state which is building roads as fast as sound business judgment warrants, and as a state which, in the meanwhile, has maintained a highway system of which most of her citizens are proud.

"I give these matters of record, not in a spirit of boastfulness, but simply in order that something of the magnitude of this great enterprise may be realized. In these accomplishments, through nearly fourteen years of service I have played my part. I am proud to have been connected with the state and with its highway work. The fact that no shadow of suspicion of crookedness or graft has ever fallen on any part of this great expenditure will always be one of my proudest memories.

State Salaries Inadequate

"I have been content to serve because I loved the work and it was my one ambition to help to give Wisconsin a system of highways worthy, if possible, of the state and of its citizenry. It has not been profitable work, in terms of money, it has been hard work and, at times, extremely trying. Nevertheless, I should gladly have continued for the rest of my active life had I felt reasonable assurance that public sentiment would support the legislature, the highway commission and the county boards in the payment of salaries adequate to maintain organizations of the proper capacity to handle with efficiency the tremendous expenditures ahead.

"Salary has been considered the only unimportant part of public office. Given any salary, any place could be filled. There would be hundreds of applicants for the position of state highway engineer if the salary were $2,500 instead of $7,500 per annum. As long as the public is willing to accept any kind of service, it can fill all of its places at any given salary. As examples of public opinion of the value of public service, Wisconsin pays its Governor $5,000 a year, its secretary of state, its treasurer, and its attorney general the same amount. She pays the members of her legislature $500 for two years' service, not enough to pay their board in Madison and their railroad fares to and from Madison, while they spend at least six months in the state's service away from their businesses, homes, and families. All of these places and many hundreds of other elective positions in state, county and all other units of government, are and will always be filled and generally well filled, because the honor, prestige and experience are worth a personal sacrifice for a limited period. However, few of these offices are the life work of the incumbent. They are either stepping stones to other things, or are the contribution to the public welfare of men who have made their stake and can afford the sacrifice. The expediency of this public policy for even this type of public service is a grave question.

"Certainly, a business undertaking of the first magnitude, such as is Wisconsin's program of highway construction, cannot be picked up and laid down by any citizen, or group of citizens, at will. It is worthy of, and must have, the service of a high class, continuing organization of the best business brains and the best engineering and administrative talent that the market affords, if the state and the counties are to expend to advantage the millions which are available and which will continue to be available for all the years to come. Hundreds of dollars can be saved or wasted at every step and millions can be made or lost by a mistaken state-wide construction or administrative policy.

"A proper organization to control this kind of construction enterprise cannot be political, it cannot suffer too great annual changes in personnel. It must be an organization able to meet on an even footing of brains, training and experience, the best organizations that the manufacturers of road machinery and materials can buy. It must be able to stand knee to knee with the best and worst contractors and get for its clients, the people of Wisconsin, good construction at a fair price. The

public must equip itself with eminently fitted representatives in this struggle, or the losses in poor roads and unjustified prices will be appalling.

"I had hoped to build up such an organization for Wisconsin. Until the public mind grasps the situation and supports a proper scale of salaries in the public service I am convinced that I cannot succeed. As fast as we train men, the best are picked for service in the commercial field. In 1920 the commission lost 27 per cent of its principal employees, and indications are that the losses in 1921 will be even greater. This will continue to be the case until the public realizes that it must protect itself by paying more nearly the market price for highway training, business experience, brains and energy.

Situation is Serious

"The situation facing the state highway organizations is serious, but the situation in the county highway organizations is infinitely worse. The salary paid the county highway commissioner in most of the counties does not attract, or if it does attract, cannot long hold in the service the type of men who should and must fill these important executive positions. In a large fraction of the counties the clerical organizations charged with the accounting for expenditures often reaching into the hundreds of thousands of dollars is not as adequate as would be required to operate properly a not too busy corner grocery store. Despite all that the commission has preached and sought to teach, the last few years have seen but little improvement in the average standard of the county organizations, while the expenditures have mounted apace.

"There is little that I can sense in the present public attitude toward public service to make it possible to hope for any great improvement in the situation. Petty savings to be made by reducing the compensation of already and always underpaid public servants are dragged forth constantly in all units of government as the panacea for all tax evils. Waste at the bunghole is lost sight of, while a pin prick through the head of the barrel is magnified into a geyser. The people cry for efficiency in public expenditures and then strangle it, still-born, by ill conceived and shortsighted financing of the supervision of those expenditures. It seems impossible to make the people, as a whole, realize that if the entire expense of all national, state, county and local legislative, executive, and clerical staffs were eliminated from their tax bills, they would sense no appreciable difference in their individual taxes. So much attention has been centered on the mole hill of public service expenditures that little regard has been paid to the mountain of public waste resulting from inadequate and ill-paid staffs of public servants.

"The consequences of this general public attitude is not so serious when only routine clerical public business is concerned, but when the states come into contact with an open competitive market for skilled service in a great construction enterprise, where the public buys hundreds of millions of dollars worth of machinery, materials, roads, and bridges from corporations, firms, and individuals who equip themselves with the best brains and experience that the market affords, the only possible ultimate result is disaster to the public and to the public purse.

"As I look into the probable future, I am unwilling to continue to take the responsibility for the proper expenditure of the tremendous funds now available longer than is necessary for the State Highway Commission and the state chief engineer to select my successor. I shall relinquish the work with the most profound regret. One does not easily surrender an almost lifetime ambition unfulfilled.

Public Awakening the Only Cure

"However, until there is a general public awakening, it must be obvious that the financial measurement by the public of the value of my services must vary so greatly from the value of these services to myself and family in the commercial field, that no other course is open for me. If, by continuing my connection with the work, I could prevent the coming disaster, it would be my duty to stay. But I, or no other one man, can stem the tide. The public must sense the danger and urge its representatives to act, if any worth while action is to be secured.

"If the whole public service cannot be properly organized, at least the public's highway organization must be put on a business basis. I cannot afford to be longer connected with it unless it is so put. Lacking that basis, both the elements of personal progress and the element of protecting my reputation as a highway engineer must impel the relinquishment of a position both unprofitable and fraught with danger to my future career.

"It may naturally be said, 'Is this not a cry of wolf, wolf? Wisconsin has done pretty well and is recognized as one of the leading states in highway construction and maintenance. There is no reason why it should not continue to do so. Hirst is an alarmist.'

"It is true that Wisconsin has done pretty well. The results have been probably 75 per cent of what they could have been made with adequate public support. Wisconsin and her counties have been lucky and have gotten better service than they paid for. But we are entering a new era. The expenditures of past years are as nothing compared to those proposed for the years to come. The competition for brains and experience of superior value in planning and building highways and for talent in all the fields allied to highway construction is keen and intense. Unless Wisconsin acts, unless her counties act, the price for self-satisfaction will be exacted. This is not a cry of 'wolf, wolf'—it is the expression of a mathematical certainty."

Kansas Governor for State-Made Cement

Governor Allen, of Kansas, in his 1921 message to the Legislature, advocates the state construction of cement mills and brick-making plants in the following words:

I believe the state could render valuable aid to road building by going into the manufacture of cement and brick to be used on state roads. For some years we have been making building brick at the penitentiary plant, and many thousands of dollars have been saved annually in the construction of state buildings by this product. Recently a scientific test was made of some shale at the penitentiary, and the assurance is obtained that we could make there a paving brick which would pass as high a test as any paving brick now on the market. It would not cost much to add to our brick plant, already established, sufficient machinery for making pavers. The presence of this product would be useful in the state's road building; it might also affect the unreasonable price now charged for brick. In addition to this the state could doubtless save much money by operating a cement plant for its own roads. If the first $1,000,000 collected from the vehicle licenses were used to start a cement plant the state could then contribute its aid to counties which were building cement roads in the form of cement at cost. In a year, with an $8,000,000 program, the saving on the cost of cement would go far toward paying for the plant. It would cost the taxpayer nothing and it would in the course of a few years save millions. The objection that this would place the state in competition with private business is not tenable because the state product would be utilized for public business only. Incidentally the indirect effect might help th egeneral public in securing relief from one of the most harmful monopolies of the day—the cement trust.

Use of Rammed Earth as "Masonry" in Building Construction

By Thomas Crane Young
Eames and Young, Architects, St. Louis

BECAUSE of the interest exhibited in the possibility of using earth as a building material, the writer made several experiments which throw light on the utility of rammed earth for small buildings. At first thought it seems highly improbable that earth could be compacted by hand sufficiently to stand in a wall. However, some briquets made with dry earth were seasoned and tested in a manner customarily followed in testing cement. The briquet specimen developed a tensile strength of from 80 lb. to 125 lb. per square inch after six days of seasoning in the form. A test for compression developed a strength of 125 lb. per square inch. Later on a small cube of earth used in the building herewith illustrated failed under compression at 475 lb. per square inch after forty-two hours of seasoning. These two tests are of little scientific value, but may serve to indicate the desirability of a more thorough investigation by qualified experts of the physical properties of compressed earth.

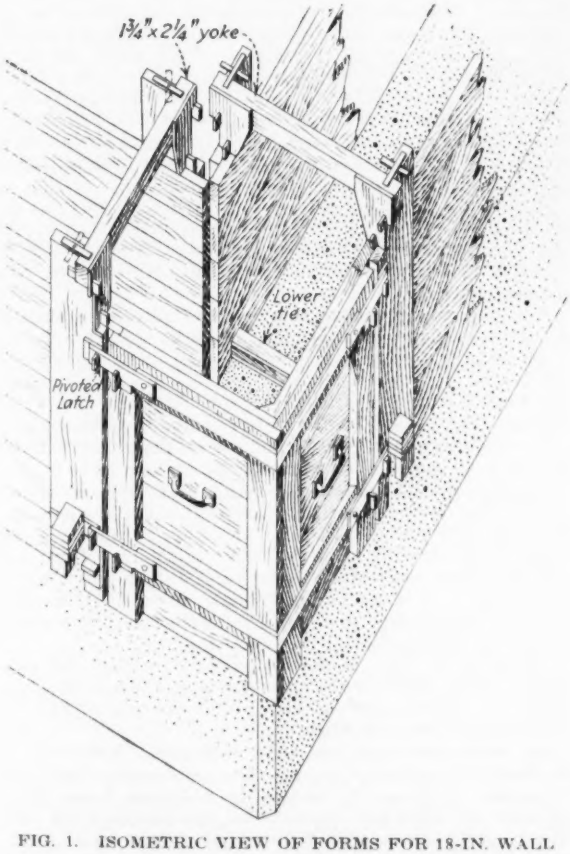


FIG. 1. ISOMETRIC VIEW OF FORMS FOR 18-IN. WALL

The building herewith illustrated was built for the David Rankin, Jr., School of Mechanical Trades, St. Louis, for the storage of oil and gasoline. While the building was to be only 10 x 13 ft. in plan, it had to be roofed and provided with a door and a window, and so it possessed most of the elements of a larger house.

The experiments have convinced the writer that earth may be used successfully for the walls of small dwellings, for farm buildings, for fences and garden walls, for similar purposes. It is also possible that it may be used for army cantonments. The application of this or any new system of construction to actual use will doubtless entail considerable preliminary study of building processes and may require some slight modification of the usual forms of architectural detail.

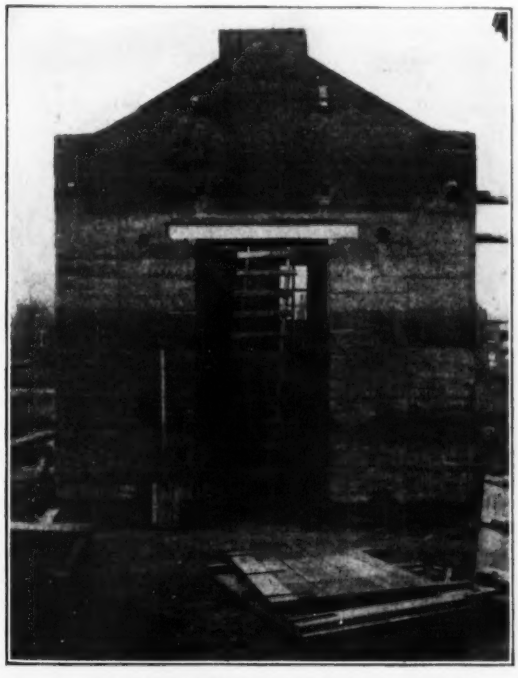


FIG. 2. RAMMED EARTH BUILDING, UNFINISHED

In the case of the building illustrated herewith a foundation of concrete extending about 8 in. above the surface of the ground was used. It is probable that an earth foundation would answer as well if thoroughly waterproofed. The earth used in the building was obtained in grading and from foundation trenches. Best results were obtained from a mixture of yellow clay and top soil in an approximate proportion of one part clay and two parts loam.

The earth should be free from roots, twigs or vegetable substances and should contain no lumps of clay or gravel larger than that which will pass through a 1¼-in. screen. In the gables, earth passing a ¼-in. mesh was used, the result being a smoother wall. When placed in the form the earth should be only slightly damp, and until used it should be protected from rain. It should be placed in the forms in layers not exceeding 4 in., pressed down, then rammed with a wooden device until solid. The end of each section of wall should be tamped to a slope which will form the joint with the next one added horizontally. Great force is not needed in tamping. A quick sharp stroke is the most effective. Wood blocks may be placed in the forms and tamped into the earth to serve as bases for the attachment of frames, wainscoting, etc. If the top of one course is dry when a second course is laid, it should be slightly sprinkled with water to insure adhesion.

As indicated in the accompanying detail sketch, the lower ties are first placed at proper distances on the wall, then the side pieces are lifted on and the top yoke

FIG. 3. EARTH BUILDING AFTER APPLICATION OF PLASTER

pressed into place. The steel plates on the yoke are slotted and halved with the iron lugs screwed to the side pieces so they hold the top of the form rigidly in place. A block, screwed to the top of the tie, holds the lower part of the boxing on one side and a similar block on the other end of the tie is hinged in order to prevent obstruction on extracting the tie from the wall. For the same purpose the tie is tapered and made in two parts, wedged apart at one end. On removing the wedge the parts come together sufficiently to permit easier passage of the tie through the hole. No doubt this device may be improved. Taking out the ties is the only difficult part of the whole process. When the wall is completed the holes may easily be filled with dry earth tamped in with a hammer or mallet, a little water being first sprinkled around the edge of the hole. Small defects arising from accidents may be repaired in the same way.

No doubt with a suitable apparatus and more experienced labor, much greater speed in building may be accomplished than we secured. It took two laborers eleven working days to lay 460 cu.ft. of earth, or the equivalent of 10,000 bricks, and by applying the local price of each type of labor one may form his own conclusion as to the comparative cost. It is almost useless at this time to attempt accurate estimates, but it seems probable that earth walls, plastered, can be built at from 35 to 50 per cent of the price of common-brick walls laid without plaster.

In this little building the author has experimented with various forms of water-proofing — with coal tar products applied directly to the exterior surface of the earth, with paint and with waterproofing material in the finishing coat of plaster. Time will determine the necessity of using any of the materials or their relative usefulness.

Alcohol from Wood Waste

Under present conditions an alcohol plant with a daily supply of 180 tons of wood waste can produce 3,600 gal. of alcohol at approximately a cost of 25c. per gallon, according to the Forest Products Laboratory. Soft-wood waste can be made to yield from 20 to 25 gal. per ton and hardwood waste only one-half as much.

California Highway Commission Defends Its Policy

Biennial Report Discusses Thickness of Concrete Slabs Criticized by Automobile Associations' Report

PORTIONS of the second biennial report of the California Highway Commission, which has just been made public, deal with questions of policy about which a controversy has been raised by the report of the board of engineers which investigated the subject for two of the local automobile associations, as summarized in *Engineering News-Record*, Feb. 3, p. 207. One of the points at issue—the thickness and width of the concrete road slab constructed—is covered by the Highway Commission report as follows:

The third outstanding feature of early road construction was the adoption of what may be termed the unit plan in road building. This plan enables a highway to be constructed which can be thickened and widened to meet larger traffic demands without the loss of the original investment. The 4-in., 15-ft. highway was sufficient for the travel for which it was built, and has taken care of an increase in traffic unthought of ten years ago. Even under the more intensive travel of today, this road is still meeting traffic needs over at least 90 per cent of the highway system. Under the stimulus of good roads, however, traffic near the large centers of population has now developed to the point that one of the pressing problems before California is that of thickening and widening these sections.

Under the unit plan of road construction, this can be accomplished without the loss of the original investment or the destruction of the original highway. The old road is included in and made an integral part of the wider and thicker highway.

This policy has resulted in giving to California a mileage in improved highways that could never have been built had roads been originally constructed to meet traffic demands of the far future, were it humanly possible to estimate either the extent or the character of such traffic. The added mileage thus secured has given to communities and counties all over California a good roads service, the value of which it is safe to say runs into millions of dollars.

Not only has this added mileage justified the commission's construction policy, but it is further justified by the fact that the alternative policy of building completed roads would have cost the state millions of dollars without due return. Huge sums would have been tied up for years in an investment, which in large part would lie idle. The interest charge upon such idle investment would in itself amount to a huge sum.

Added to all this, is the undoubted fact that the good roads mileage built by the state has been the largest single factor in stimulating counties into campaigns for the improvement of local roads.

In accordance with the early determined policy of the Highway Commission, i.e., to make construction take care of present traffic and to reasonably anticipate future traffic growth, the Highway Commission has increased its minimum specifications from four inches of unreinforced concrete to five inches of reinforced concrete. Practically all construction under the $40,000,000 bond issue has been in accordance with these new specifications.

In this connection, it should be noted that the steel used in reinforcement and the extra inch of concrete have made a very material increase in the cost of constructing roads. We believe, however, that there can be no question of the wisdom of this expenditure.

The desirability of including in the specifications provision for a road of a minimum width from 18 to 20 ft. has been given very serious consideration by the commission. It is the opinion of the commission that to adopt a uniformly wider pavement than the 15 ft. slab would reduce mileage to an extent not warranted by the service that the

increased road width would give. It is the further belief of the commission that the better plan for new construction is to build the wider pavement where the need for a wider road either now exists or will soon exist.

The plan that has been followed by the commission in widening and thickening the pavement has been twofold in character. In some places a second concrete slab has been placed over the original slab. In other places concrete shoulders have been built 1½ in. higher than the original slab and the trough filled with asphaltic surfacing.

At the present time the commission is building a 5-in. oiled macadam road using the original concrete slab as a foundation on certain sections in the rice growing district, where, owing to inundation of the road bed from adjacent rice fields, disintegration occasioned by alkali salts carried in solution in this water and the excessive loads hauled on the roads, the concrete slab has been broken into fragments.

The commission urges more stringent regulations for the protection of the highway system and that legislation be enacted to require rice growers to keep drainage water from their fields off the highway right of way. In certain sections the highway has been converted into a veritable marsh by such water. No type of hard surface road, it is claimed, can be maintained under such conditions. This practice has cost the state hundreds of thousands of dollars. The present law which provides for recovery after the damage has been done has proved inadequate to deal with the abuse. It is time, the commission believes, that action is taken to stop the flooding of state highways, and their consequent destruction.

Overloading of trucks and reckless speeding by drivers of loaded trucks is also endangering the state highways, according to the report. The remedy is more adequate policing of state highways, and legislation to secure this is necessary. Experience in the enforcement of traffic laws convinces the commission that best results can be obtained by the enforcement of traffic laws on state highways by a state police, the members of which are independent of local control and local influence.

San Francisco Garbage Rates Revision

A sub-committee of the San Francisco Board of Health is conducting hearings on rates for garbage collection in that city. Until recently the arrangement of rates and routes has been in the hands of the scavengers themselves under the so-called license system which calls for only nominal supervision by the Board of Health. The rates in effect vary from 50 cents per month for small households to $30 per month for some apartments. An endeavor is being made to establish a fair basis for classifying these rates. The collection routes at first crossed and re-crossed. Later the scavengers formed combinations, pooling their trade and organizing routes for systematic collection. This reduced the number of wagons to about 25 per cent of the original requirement. Except for certain hotels that sell their swill to hog raisers at $3 to $5 per ton, no segregation is attempted in San Francisco. About 380 to 400 tons of garbage is now collected and delivered daily to the old refuse destructor of the Thackeray type. (This destructor was described in *Engineering News*, May 17, 1900, p. 318; it was built under a private franchise, operated privately for some years, and bought by the city in 1909). The garbage is weighed on delivery at the destructor and the scavengers pay $1 per ton for its destruction. This charge is designed to cover maintenance and operating costs at the destructor, which is now owned by the city.

Reconstruction Needed on New York State Highways

Annual Report for 1920 of Commissioner Greene Reviews Year's Work and Urges Definite Highway System

WITHIN the next three years 1,204 miles of New York State highways will need reconstruction or resurfacing. This is the "note of warning" sounded in the annual report for 1920 of Frederick Stuart Greene, state commissioner of highways, which has just been made public. The report points out that the New York State highway system has reached a point where reconstruction is more important than is new construction. It reviews the work of the year and makes a plea for the establishment of a definite and fixed highway system which cannot be altered continually in the interests of political expediency. A summary of the report follows:

At the height of the season of 1920 there were under operation at one time 184 contracts for the construction and reconstruction of 803 miles of highways. Due to the high prices of materials and the difficulty of securing competition among contract bidders, the commission, on April 24, discontinued lettings. Results have proved, Commissioner Greene states, that this action was for the best interests of the state, economically, and saved it from having a number of abandoned and unfinished contracts.

During 1920 contracts for construction, reconstruction and improvement were awarded as follows:

New Construction and Completion Contracts	
1 project (Rondout Creek Bridge)	$657,241.60
43 projects for 170.88 miles	5,419,078.00
Reconstruction	
41 projects for 99.45 miles	2,950,547.86
Surface Treatment	
5 projects for 133.95 miles	110,190.30
Total, 90 projects, 404.28 miles	$9,137,057.30

The necessity for reconstruction is greater now than it was twelve months ago, according to the report, for many lightly built highways which still have some value in their pavements will lose that value unless they are promptly reconstructed. Many miles of road are said to have reached the elastic limit and are in a condition where further patching is not only uneconomical but a waste of money. In reports received from the commission's nine division engineers the following mileage of highways for reconstruction or resurfacing within the next three years is certified: Cement-concrete reconstruction (542.82 miles; bituminous macadam reconstruction, 527.54 miles; bituminous macadam resurfacing, 133.30 miles; total, 1,203.66 miles. If, owing to lack of contractors, it is found impracticable to carry on both construction and reconstruction, the building of new highways, the report emphasizes, should be deferred until the state can complete the necessary reconstruction.

Mileage Policy Bad

New York State, it is claimed, is suffering today from the mistaken policy pursued in former years of trying to secure the greatest possible mileage for the least possible money. All other states now carrying on extensive highway improvement, profiting by the experience of New York State, are building 90 per cent of their improved road mileage of the most durable types.

In these days of the motor truck and heavy roads Commissioner Greene is of the opinion that "it is indisputably the sounder business policy to build roads for a longer yearage rather than for a longer mileage."

The Federal appropriation of $3,237,630 was met by the legislature for 1920 construction. In order to secure the Federal aid apportionment due in 1921, amounting to $4,727,117, it is requested that the state appropriate $5,250,000 to match the Federal appropriation and to cover the costs of making preliminary surveys and plans. At present plans for new Federal-aid projects which have been submitted to and approved by the government cover a total of 200.45 miles, of which 115.64 miles are to be built on designated state routes and 84.81 miles on routes not so designated. The commission is in sympathy with the policy of utilizing prison labor to perform the preliminary work on roads where heavy grading is necessary. Prison labor has been found to be more efficient on this type of work than on building a finished road.

Gang System Favored

The report comes out emphatically in favor of the "gang" system as against the patrol system for road maintenance. In one division, during 1920, no patrolmen were employed, all work being done by gangs. For patching, painting of guard rails and similar light work, small gangs of from two to four men were employed, while for the heavy reconstruction work gangs running as high as twenty men were used. The division engineer reports as follows:

"The gang system in this division has demonstrated that there is no comparison with the patrol system in any phase or feature of the work. The gang system, which is more mobile, always concentrates its efforts on the sections of highways which need repairs; this is not true of patrolmen, for the reason that they were appointed to local beats."

The report requests a change in the highway law which would permit the purchase by the state of materials used in highway construction. Substantial savings could thus be effected, it is claimed.

Definite System Needed

The report deplores the fact that the state has no definite and fixed highway system. Three classes of improved roads—state routes, state-and-county highways, and Federal-aid roads—are being built wholly or in part from state funds. The only fixed locations are for those highways built as state routes; state and county highways are subject to change by boards of supervisors and Federal-aid roads by the New York State Highway Commission. On this general subject the report comments as follows:

"This is manifestly a bad policy, and in the interest of the taxpayers it is essential that the location of the roads of our highway system should be definitely determined by law, so that they may be built where they will serve the greatest number and not be subject to changes in the interests of any one person or group of persons. A striking evil of permitting modifications and changes in road location is the temptation to use such changes to have surveys made on roads when there is no real intention of construction.

"A study of the map of the highways already completed by the state shows that there are isolated, disconnected stretches in practically every county in the state; also that at many points roads have been built closely paralleling others, while in other parts of the same county large areas exist where no highway improvement has been undertaken. These conditions indisputably show that many roads have been constructed in the past, not with the view of serving the majority, but to accommodate favored persons or communities.

"To put a stop to these evils and to prevent opportunity for using the construction of highways for selfish purposes, this commission has had prepared a map showing a connected and completed system for the state."

The map shows a total of approximately 12,880 miles of approved routes.

The report concludes with a recommendation that the state law be so drawn that the Highway Commission would not have power to survey, advertise or award a contract for any road which did not connect with some portion of the already completed highway system, or a state highway being constructed, except where the proposed new highway would connect with a street within the limits of an incorporated village or city.

Steady Progress on Hetch Hetchy Mountain Division

CONSTRUCTION is progressing all along the mountain division of the Hetch Hetchy project, says M. M. O'Shaughnessy, city engineer of San Francisco, who made the following report after a recent inspection tour of the work:

At the site of the main dam the excavation for foundation has been carried 20 ft. below river bottom. Very little water has been encountered. A force of 175 men is working in three 8-hour shifts on this part of the project. Two steam shovels are excavating in the unwatered area, delivering to dump cars which haul the spoil to a dump downstream. The Utah Construction Co., contractor on the dam, has installed about $1,000,000 worth of equipment at the site and is preparing to pour concrete at the rate of 1500 cu.yd. per day as soon as the foundations are ready.

On the 18-mile tunnel about four miles have been excavated and the six headings are now being advanced daily at the following rates: Priest, 14 ft.; Big Creek east, 7 ft., Big Creek west, 7 ft.; South Fork east, 9 ft.; South Fork west, 12 ft.; Early Intake, 10 ft. Within two months four new headings will be opened and the work is then expected to progress at the rate of 3,000 ft. per month.

Plans for the earth fill dam at Priest, to contain about 825,000 cu.yd., have been completed and a call for bids is to be advertised within a few months. This structure is estimated to cost approximately $1,000,000. Plans for Moccasin Creek power house, the first installation in which is to be for 66,000 hp., are well under way and contracts are to be let in ample time to have the plant ready for service as soon as water could be delivered to it.

The city's sawmill will be kept in operation this year throughout the winter season. This is the first time in the history of the project that the extent of work under way has made this necessary.

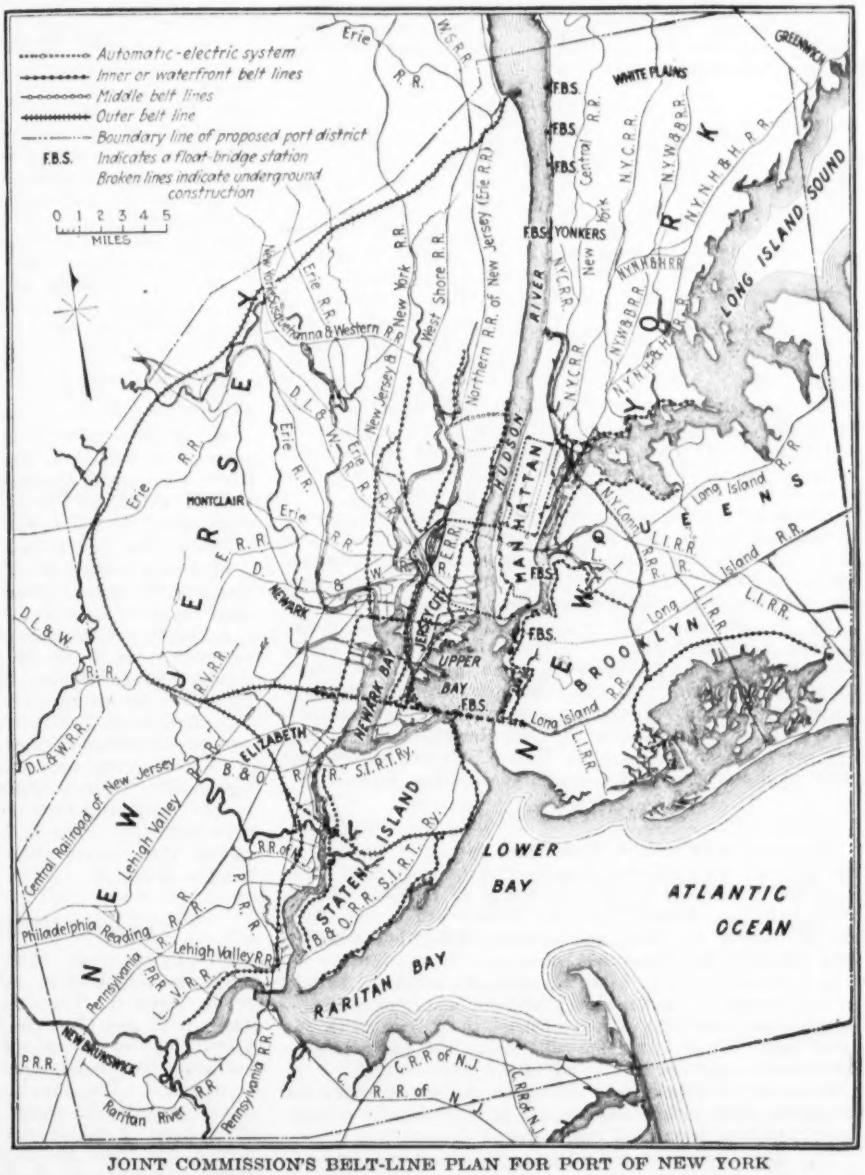
Few Water Supplies in Czecho-Slovakia

Municipal water supplies exist in only 16 per cent of the cities of over 4,000 population in Czecho-Slovakia and the Carpathian district of Russia, according to a report by Colonel F. F. Longley, chief of the department of sanitation of the League of Red Cross Societies, as published in the *Bulletin* of the League for October, 1920. The water systems of the large cities are said to be in general well built and designed to assure a safe supply. In most of the towns, villages and rural districts, says Colonel Longley, one sees very commonly the dug well with its long sweep. The water level is usually not far below the surface of the ground, from 10 or 12 ft. to 30 ft.

Belt Line Plan Recommended for Port of New York

THE SYSTEM of belt lines, spurs and marginal railroads to bring direct rail connection to the greater part of the water front of New York Harbor, except Manhattan Island, as recommended in the report of the New York-New Jersey Port and Harbor Development Commission is shown in the accompanying map. The summary of the commission's report, made public Jan. 24, 1921, was reported in *Engineering News-Record*, Jan. 27, 1921, p. 182, and included the recommendation for building an underground "automatic-electric" freight subway loop system for Manhattan distribution and collection.

The recommended surface belt-line system includes joint marginal surface belt lines and spurs to serve navigable water fronts of the port for the development of steamship terminals and industrial enterprises. The outer belt line extends from Piermont above the Palisades to Bayonne, Staten Island and Perth Amboy, passing west of Paterson and the Orange Mountains. Connection between the New York and New Jersey systems is proposed first by car ferry across, and ultimately by tunnel under the Upper Bay. Brooklyn and the East River section of Queens would be served by the Long Island-New York Connecting R.R. from Bay Ridge to Hell Gate, and by marginal lines, not necessarily continuous, but reached by float bridges or by spurs from the Bay Ridge-Hell Gate line, from which spurs are to be run to Jamaica Bay and Flushing Bay. Marginal lines would skirt the Harlem and East Rivers in the Bronx from Spuyten Duyvil to Throggs Neck and other lines are virtually to encircle Staten Island. Yonkers and the communities north are to be served by joint car-float stations reached from Piermont. Existing belt lines would be improved to serve the Hudson River and Upper Bay water fronts in New Jersey. New lines along both sides of Newark Bay and the Hackensack River, the west bank of the Arthur Kill and the north bank of the Raritan River are to serve Newark, Jersey City, Bayonne, Elizabeth, Perth Amboy and other communities.



JOINT COMMISSION'S BELT-LINE PLAN FOR PORT OF NEW YORK

The commission states that the Long Island belt-line railroad system would form a part of a more comprehensive belt system for the entire port, and for New Jersey recommends that there be three classes of belt lines, designated as inner, middle, and outer lines. The commission's "Summary of Joint Report" contains the following explanation of the belt-line plan:

The primary purpose of the inner or waterfront belt lines is to serve steamship terminals and industries along their routes.

Nuclei for two such belt lines already exist—one the fragmentary Brooklyn marginal railroad referred to on the preceding page, the other the National Docks Railway, the New Jersey Junction Railroad and the Erie Terminals Railroad, which collectively extend along the east base of Bergen Ridge and the Palisades from Bayonne to Edgewater. Both will require improvement as to alignment and trackage.

A number of other marginal railroads are indicated on the comprehensive plan along other navigable waters in both states. The proper sequence of construction should be determined by the permanent Port Authority in collaboration with the communities affected. The lines need not be continuous, but each must have easy access to the other parts of the belt-line system.

There should be one middle belt line on each side of the

Hudson. The Long Island-New York Connecting Railroad and the line recommended along the Harlem River from Spuyten Duyvil to the East River will constitute the middle belt line for New York. That for New Jersey will have to be built, and should extend along the east side of the Hackensack Meadows as shown on the comprehensive plan, connecting with all of the railroads.

The primary purpose of the middle belt lines is to afford a means for the direct interchange of cars between railroads and a thoroughfare for all of the railroads of the port to and from the joint car-float and joint lighterage stations recommended by the Commission. Because these cars almost invariably require classification at the break-up yards, the proposed belt line in New Jersey is located wherever possible just east of those yards.

Outer Belt Line

The third class belt line, the outer belt, is at first required for New Jersey only. It should encircle the entire western half of the Port, from tidewater on New York Bay to tidewater well up the Hudson River, passing outside of the break-up yards. Its chief immediate purpose is to serve as a bypass around the congestion nearer the waterfront for all freight that need not pass through the break-up yards, and as an auxiliary to the middle belt line, the capacity of which bids fair to be taxed by the increased traffic of the next decade. The traffic that can be diverted may include trainload shipments to and from steamships, interchange between the New York Barge Canal and the New Jersey railroads, railroad interchange originating at or destined for points beyond the break-up yards, such as Paterson, and traffic between the New Jersey railroads and Yonkers and the communities to the north of that city, which can be reached from Piermont by a car-float service.

This is by far the most extensive of the belt-line projects recommended, and the one requiring the most extensive study. A tentative location has been established through a survey made for the Commission by the forces of the State Engineer and Surveyor of the State of New York.

The line as located will begin at Piermont, N. Y., on the Hudson River, pass southwesterly to the west of Paterson, N. J., and the Orange Mountains, come through the Orange range near Summit and continue in a generally easterly direction to termini on deep water, reached by short branches. It is proposed to establish one such terminus on Newark Bay, one in Bayonne along the Upper Bay, one on the east shore of Staten Island and one on the Raritan River.

Steamship Terminals

Steamship terminals will naturally be built at each of the southern termini, and a Barge Canal terminal at Piermont. A large classification yard will be required on this outer belt line, probably in the vicinity of Newark Bay, and the middle and inner belt systems should be connected with the outer belt near that yard.

In a relatively short time the railroads will need to add to their break-up yard facilities, and the additions will presumably be built at the junctions of their lines with the outer belt. These additions will enable the outer belt to serve more and more as a relief to the middle belt.

All of the new belt lines will open up new territory for industrial development, and should in time handle a large amount of local industrial traffic.

The engineering staff of the commission consists of: B. F. Cresson, Jr., chief engineer; W. W. Drinker, terminal engineer; J. E. Ramsey, chief statistician; C. W. Stark, engineering editor.

Safety Lessons for Automobile Drivers

A set of twelve safety bulletins and safety lessons for automobile drivers is being distributed by the National Safety Council, 168 North Michigan Ave., Chicago. The charge for the sets of lessons is 15c. for single sets and 9c. per set in large quantities.

Letters to the Editor

It is the editors' desire to publish here all worthwhile letters pertinent to the interests of engineers and contractors. In order that this may be possible contributors are asked to condense their letters to the shortest space consistent with a clear presentation of their ideas.

The Hydraulic Jump Again

Sir—In your issue of Jan. 20, 1921, p. 135, there is a letter on "The Hydraulic Jump," by Jeptha A. Wade. Why Mr. Wade should question the statement that "the first derivative of the area with respect to the depth is the width at the top of the water" is not apparent. Reference to any integral calculus will show that to obtain the area in question the differential area is taken as xdy.

It may be of interest, however, to state that Mr. Wade's differentiation of the equation for the area of a triangular section is incorrect. He treats T as a constant, while it is in fact a variable, having in a given triangular channel a constant relation to d. If this constant relation is designated by the letter K, so that $T = Kd$, then

$$A = \tfrac{1}{2} Kd^2,$$

and differentiating $dA/dd = Kd = T$, which leaves equation (9) undisturbed.

Mr. Wade's interest in the discussion of the hydraulic jump is appreciated, and it is hoped that he will challenge other questionable points. It might, however, be of mutual advantage to all concerned if debatable points were discussed "out of court" before publication.

Denver, Col., Jan. 25. Julian Hinds.

[Through oversight we did not submit Mr. Wade's criticism to Mr. Hinds before publication as is our custom in such cases.

A letter pointing out Mr. Wade's error has also been received from A. G. Husted, assistant engineer, Department of Public Service, Cleveland, Ohio. Mr. Wade begins his letter by an appreciative reference to the article, "A Few Lapses in Textbooks," by R. Fleming, in our Engineering Literature section of Jan. 20, p. 125, and cites Mr. Wade's letter as an example of a similar lapse. All such lapses, Mr. Husted urges, emphasize the danger of following "empirical formulas or even generalized statements set forth in various textbooks without first investigating them as to their applicability to the problem in hand."—Editor.]

Federal Highway Appropriations

Sir—*Engineering News-Record* is to be congratulated upon its illuminating editorial in the Jan. 13 number, p. 50, entitled "Federal Highway Appropriations." We agree with you that the federal-aid act has won wide approval, but we cannot agree with your statement that "its operation has disclosed no major direction in which change is needed." The suggestion of having the states themselves provide the funds with which to meet the federal aid instead of calling upon the counties is a change much needed, for there are now approximately one-third of the states using county funds to meet federal aid, and their highway departments are, therefore, merely clearing houses through which the Federal government co-operates with the counties in building roads.

A state, unable or unwilling to adopt a system of taxation by which all contribute in proportion to their wealth toward road improvement, and which pursues a policy that results in roads in rich counties and in pauperizing poor counties should be penalized in not receiving federal funds for roads within its borders. If the wealthier states are willing to contribute money to help the poor states build roads, then it follows that the prosperous counties should be willing to help build roads in the undeveloped counties.

In addition to the amendments made in the MacArthur bill and the one suggested in your editorial there is another change in the federal-aid act which should be made before more federal appropriations are provided, and this has to do with some plan which will insure proper maintenance of federal-aid roads. The only remedy the federal government has to require maintenance is that the Secretary of Agriculture may refuse to approve any new project *in a state or civil sub-division thereof, as the case may be,* if the roads already built are not properly maintained.

There are now about seventeen states in which funds for meeting federal-aid roads are raised largely by the counties; hence, the initiative rests with those counties and the road is maintained by the county under state supervision.

Let it be supposed that a federal-aid road has been built across one of these counties and is not properly maintained. The government then gives notice to the state, which, in turn, passes the notice on to the county, that unless the road is properly maintained further federal aid in that county will be withheld. The county, knowing that it has received all the federal aid which it can reasonably hope for within the next few years, would be inclined to do pretty much as it pleased with reference to the maintenance of any road complained of.

It would seem quite necessary that the maintenance clause of the existing aid act should be greatly strengthened before additional appropriations are made thereunder.

M. O. ELDREDGE,
Director of Roads, A.A.A. Good Roads Board.
Washington, D. C.

Marshall Plan for All-California Irrigation Held Chimerical

Sir—R. B. Marshall, formerly chief geographer of the U. S. Geological Survey, has proposed a scheme commonly known as the "Marshall Plan" for the development of irrigation and power in the great central valley of California. This plan has been extensively advertised in the past six months and is now being carried to the legislature, with the request for an appropriation of half a million dollars to further the scheme. Mr. Marshall is authority for the statement that $1,000 a month is being spent for postage stamps to send out literature regarding the scheme. Such widespread advertising of an engineering plan which to date has not received careful study by responsible people should not be allowed to go unchallenged.

The Marshall plan provides for the collection of all the streams which enter the great central valley of California into a series of grand canals skirting the mountains on both sides of the valley and distributing the water to the land and developing, incidentally, hydroelectric power. The waters of the Sacramento valley are carried south into the San Joaquin valley, where land is more plentiful than water. The Kern River, at the southern end of the valley, is taken through a tunnel under the mountains to the Mojave desert in southern California. In order to compensate the valley for this water taken out of its shed, the Klamath River is to be brought over the Shasta divide and dropped into the Sacramento valley. Statements concerning this plan are so filled with glittering generalities of an attractive nature that many well-meaning people are impressed by them and have loaned the influence of their names to the promotion. No one whose opinion on irrigation or power matters is worth considering has so far endorsed the plans as feasible, and all who have looked into it consider the scheme most ill-conceived and chimerical. Engineers who have devoted their lives to the irrigation and power business regard the plan as having no point of merit and know it to be altogether fantastical. It will do much harm to the serious development of the state and will cause many people to class the engineering profession with these promoters, much to the detriment of the profession.

The Marshall plan would, if carried out, first of all destroy all vested rights to water. It would substitute for these rights an indefinite interest in the waters of a stream or streams possibly miles away. It will confuse and disrupt the efforts of fifty years to bring about some system in the distribution of water and will offer no advantage to the millions of acres now being irrigated. It will destroy many power and irrigation developments now under operation or being developed.

Every stream entering the great central valley has already some well-defined plan for water conservation now under consideration. The reason these do not go forward faster is because of the difficulties in settling the question of water rights or of the high cost of the work. If the settlements of the difficulties in one of these smaller projects is so hard to accomplish, how little chance there is for this tremendous scheme which involves wiping the state clean of all rights and redistributing the waters of the greater part of the state at a cost of billions of dollars!

The literature sent out by this organization is full of misstatements. Mr. Marshall, in one of his talks recently, said that the execution of his plan would make unnecessary the carrying out of the existing flood control project. Not only this, but he states that the whole system of leveeing the Sacramento and San Joaquin Rivers (and the Mississippi also) is a great mistake—worse than useless.

Cost alone will kill the plan, for the seven hundred million talked about by Mr. Marshall will not start the work. Its cost will probably be billions!

There is no need for any large expenditure to investigate this matter. A group of experienced irrigation men can prove it chimerical without expensive surveys.

San Francisco, Jan. 31.

GEO. S. NICKERSON, THOS. H. MEANS,
H. H. WADSWORTH, J. D. GALLOWAY,
MAX W. ENDERLEIN, W. L. HUBER.

A 24-Foot Water-Wheel Pump in Wisconsin

Sir—I read with interest O. Sherven's description of primitive water wheels in China in your issue of Jan. 20, p. 134. During the summer of 1919 I was making surveys for water power development on the Namakogen River in northern Wisconsin and found a home-made water wheel of this type. The wheel was about 24 ft. in diameter and was driven by the current of the river, as there was no waterfall or rapids at this point. The water raised by this method was used to flood cranberry swamps about a half mile distant. The country was sparsely settled and the owner of the cranberry swamp found pumping by gasoline engine and centrifugal pumps too expensive and so used this old Chinese method instead.

Foreman, Ark., Jan. 24. D. CUYLER WASHBURN.

Concerning the Proposed Redesign of the Belle Isle Bridge

Sir—I notice in your issue of Jan. 29, p. 190, a news article relative to new design for the Belle Isle bridge, and I wish to make certain comments.

The design for the Belle Isle bridge was made by the Belle Isle Bridge Commission, consisting of: Mortimer E. Cooley, Francis C. McMath, William R. Kales, Emil Lorch, and Henry E. Riggs. Added to this commission was Prof. Lewis M. Gram, who acted as engineer on the work. That article relative to new design for the Belle Isle bridge, and not in any sense a "steel bridge faced with concrete," as is quoted in your paper.

It is untrue that the construction of a bridge of the reinforced concrete arch type would employ practically 50 per cent more labor than the bridge designed by the commission, as you say "is stated." It is untrue that a bridge as mentioned in your article can be constructed using materials which can all be obtained locally (the reinforced-concrete cantilever bridge designed by the commission will use local materials) and that its construction could be begun immediately, as no plans for a reinforced concrete arch bridge have been completed which will be approved for this site.

The statement is made that practically 50 per cent more labor will be required on this proposed reinforced-concrete

arch bridge than on the original design, and yet it is proposed by Mr. Luten to bring the cost down to $2,600,000, while the estimates on the reinforced-concrete cantilever bridge after two bids amounted to over $4,000,000. You cannot increase the labor 50 per cent and at the same time provide everything as is required by the original design and reduce the cost $1,500,000.

The nature of the soil on which this bridge is to be built is of such a consistency of blue clay that the bridge commission, after a year's study, decided unanimously that only a bridge in which all the actions were vertical would be safe on that soil, and after they had considered not only the reinforced-concrete arch bridge but all other types they decided that the reinforced-concrete cantilever type was the only safe type to be used.

Mr. Luten has presented nothing new in his proposed plan, yet he is acting with full knowledge as to the investigation and study which the original bridge commission made on this matter.

Detroit, Jan. 31. H. H. ESSELSTYN,
Esselstyn-Murphy, Engineers.

Why States?

Sir—Nothing can be more pathetic than the huge docility with which suffering humanity goes on hugging and extolling the fetters with which its forbears have bound it. The fathers have eaten sour grapes, and the children's teeth are set on edge. Happily, the children are not wholly debarred from voicing their discomfort.

In *Engineering News-Record* of Jan. 27, p. 157, R. I. Meeker, in his paper on "Interstate Water Conflicts and Possible Solution," describes the 'pretty mess' arising from the fact that "physical conditions . . . are antagonistic to divided authority." This should teach us to beware of saddling, upon our descendants, institutions, which, while they may have some value for us today, must be but millstones about their necks.

Before the advent of the steam engine ushered in modern industrial conditions, and while New York was much farther from Lake Erie than it now is from the Pacific, there was perhaps some excuse for the politicians who carved our unhappy country into "sovereign states" and separated these little "sovereigns" by boundaries which, as Mr. Meeker remarks, "do not coincide with drainage basins."

Today these "sovereign states" number forty-eight, each with its own governor and its own cumbrous legislature busy grinding out laws in conflict with those of its neighbors; and Mr. Meeker's paper sharply reminds us what a tangled web we weave for posterity when we thus bindly follow the calf paths of our ancestors.

But Mr. Meeker's paper nevertheless is not without encouragement for the optimist. For instance, it is profoundly reassuring to find Mr. Meeker asserting that the hodgepodge, which he so graphically describes, is "commencing to awaken thinkers among engineers" and others.

It is by the pressures of ill-adjusted environments, rather than by the *a priori* reasonings of reformers, that conditions get ameliorated.

As a rule, things must get pretty bad before the awakening of thinkers is commenced. Pharaoh, hardening his heart until the first-born were slain, is typical of conservative humanity in general. It has required a World War, threatening the destruction of civilization, to commence awakening thinkers to the eminent necessity and practicability of what, seventy years ago, was regarded as only a poet's dream: "The parliament of man—the federation of the world."

But if the awakening has really commenced (and we have Mr. Meeker's word for it), the outlook is not hopeless. Emerson has said, "Beware when the great God lets loose a thinker upon this planet!"

If, as Mr. Meeker tells us, the thinkers have already been forced to the conclusion that "some legal adjustment of state water laws . . . must be reached"—if they have already formed a "League of the Southwest"—how much longer can they hold out against the obvious need of a League of the United States or of the World?

How much longer can they refrain from insisting upon the abolition of our antiquated and generally arbitrary interstate boundaries (and of the "states" and their state governments with them) and upon the recognition of a single nation, or state, divided (not for political but only for administrative purposes) into main and subsidiary districts co-extensive with our main and subsidiary drainage basins? JOHN C. TRAUTWINE, JR.

Philadelphia, Pa., Jan. 29.

[Those interested in the specific application of Mr. Trautwine's spirited discussion, summarized in his concluding paragraph, may find the same general idea elaborated at some length in a letter by C. G. Lyman, mayor, Royal Engineers, British Expeditionary Force, in *Engineering News-Record*, July 31, 1919, p. 239, entitled "A Plea for Making Watersheds and Administrative Areas Coincide" (which, by the way, is a rare instance of the use of "watershed" in its proper sense). The relationship between administrative areas and watersheds or river drainage basins, we add, is a subject worthy of consideration by engineers, legislators and government administrative officers. To reinforce his remarks on blindly following "the calf paths of our ancestors" Mr. Trautwine sends a clipping from the Philadelphia *North American* of Dec. 6, 1915, containing some forceful humorous verses by Samuel Walter Foss, entitled "The Calf Path," which, though familiar to many, deserve wider reading. The verses may be found in the humorous section of Stevenson's voluminous "Home Book of Verse" and presumably in other anthologies.—EDITOR.]

Code of Ethics for Engineering Profession

Sir—My attention has been called to an editorial entitled "No General Code" in your Dec. 2, 1920, issue, in which you disparage our efforts to prepare a common code of ethics for the engineering profession. One would infer from your editorial that the ethics of the civil engineer are essentially different from those of other classes of engineers and therefore that it would be impossible for civil engineers to join with the others in considering a common code.

Your attitude in this is not well founded. There can be no difference of opinion as to the fundamental basis for a Code of Ethics. This must essentially be a statement of right, just and honorable conduct in the relation of engineers with the public, with the employers, employees or clients, and with fellow engineers. Opinions may differ regarding the form in which these statements may be framed but not to any extent about the fundamental ideas. The Golden Rule was not intended for any one class of engineers. The fundamental justice of the Square Deal is recognized by all. Therefore, since the underlying principles to govern professional conduct are readily recognized, and can be applied generally by all engineers in their daily work, the logical thing to do is to prepare a Code of Ethics for the whole profession which will state these guiding principles in terms applicable to engineers. This is what our Committee on Ethics had in mind when an invitation was sent to the other Societies to join with us in considering the preparation of such a Code.

It is time that engineering became recognized as one of the learned professions just as law and medicine. This can only be attained when the public recognizes high ideals of service to the state, to their profession and to individuals on the part of all engineers. The best way to ensure such ideals among engineers is by jointly subscribing to and enforcing a code of ethics in which such ideals are stated. The public will never consider engineering more than a trade as long as any one group of engineers insist they have all the virtues and the others most of the vices. Our committee hopes, with the help of engineers in all professions, not only to prepare a code that will be acceptable to all, but also to recommend procedure in administering it. We hope that *Engineering News-Record* can yet give us its co-operation, assistance and criticism in the preparation of such a code of ethics.

A. G. CHRISTIE,
Chairman Code of Ethics Committee, A. S. M. E.

Baltimore, Jan. 17.

NEWS OF THE WEEK

New York, February 10, 1921

$10,000,000 for Wilson Dam Approved by Senate

By a vote of 36 to 27, the Senate has approved the appropriation of $10,000,000 for continuing work on the Wilson dam at Muscle Shoals on the Tennessee River. Whether the conferees on the bill will retain the item is problematical. The Appropriations Committee of the House refused to embody the item in the bill which it drafted. An unsuccessful effort was made on the floor of the House to add the item to the bill. After a hard fight in the Senate committee an amendment to the House bill was approved. The Senate itself approved the item on Feb. 5.

More than $12,000,000 already has been expended on the dam. An additional $5,000,000 will have been expended by May 1, it is estimated. In addition to these amounts, Colonel Hugh Cooper estimates that $33,000,000 will be required to complete the project.

Senator Smoot of Utah favors abandoning the project. He thinks it is better for the government to take its loss now rather than to spend more money. Senator Lenroot of Wisconsin, another of the more active opponents of the project, favors suspending work for two or three years so that the proposition can be investigated more closely.

Approaches of Lincoln Memorial Must Be Underpinned

The terrace wall, the walks and the steps of the Lincoln Memorial at Washington, D. C., have settled to the point where the engineer and architect in charge have asked Congress to provide funds to enable them to put in foundation piers to bed-rock. The original plans called for rock foundations for the terracing and approaches. In an effort to expedite the work and to reduce the expense, the plans were changed and a spread slab concrete foundation was substituted, though the foundations of the building itself were sunk to rock. The memorial is on filled ground which has been consolidating from nine to thirty-four years. The changes now found necessary are estimated to cost $363,000. The total cost of construction for the Lincoln Memorial up to Jan. 1, 1921, has been $2,589,188.24. The settlement in no way affects the Memorial building itself

Licensing Bill in W. Va.

A bill to license engineers has been introduced in the West Virginia legislature by the American Association of Engineers and the West Virginia Engineers' Society.

Hirst Resigns as Chief Engineer of Wisconsin Highways

A. R. Hirst has submitted his resignation as chief engineer of the Wisconsin Highway Commission to take effect not later than Dec. 31, 1921. As explained in a statement by Mr. Hirst on p. 265 of this issue, he is unwilling to assume responsibility for the state's highway work with the underpaid staff which the present organization policy allows him.

Mr. Hirst was born in Elmont, N. Y., in 1881, and was graduated from Maryland Agricultural College in 1902. His professional experience includes service

A. R. HIRST

with the Pennsylvania R.R., the highway division of the Maryland Geological Survey, the Illinois Highway Commission and the Wisconsin Geological Survey. In August, 1911, Mr. Hirst became acting state highway engineer of Wisconsin and the following year he was appointed chief engineer of the Wisconsin Highway Commission, in which position he has served continuously to date. In 1912 he was elected president of the American Association of State Highway Officials.

To Hold Highway Education Conference

Under the auspices of the Permanent Committee on Highway and Highway Transport Education, the University of Michigan and the Michigan State Highway Department, a mid-western conference on highway and highway transport education will be held in Ann Arbor, Michigan, Feb. 23.

Canadian Engineers Hold Annual Meeting

Legislation and Grading of Members Most Discussed—Professional Sessions in Sections

The thirty-fifth annual general and professional meeting of the Engineering Institute of Canada was held from Feb. 1-3 at Toronto, Ont., and fully equaled in enthusiasm and attendance the record which has come to be expected of these meetings. Over 600 members and guests were registered and the attendance at the several meetings seemed to indicate that little of the registration was merely nominal. As is customary with the Canadian meetings, the social features were emphasized. On two of the three days there were luncheons with over 300 present and on each of the first two evenings there were entertainments, on the first night a lively smoker and the second a banquet of exceptional brilliance as regards speakers. An innovation this year was the sectionalization of the professional meeting for one day. Instead of a joint session there were five, devoted respectively to municipal, electrical, structural, chemical, and mechanical subjects. On the last day there were illustrated lectures on subjects of interest to all the members.

Council Report

The Council report for the year 1920 showed the Institute to be in a thriving condition. A deficit of last year has been transformed into a surplus of over $6,000 and the membership has increased so that at present there are 4,173 enrolled. The local branches, which have been so emphasized in the policy of the Institute, are equally thriving and two additional branches, one at Moncton, N. B., and the other at Sydney, N. S., have been added, making now twenty branch societies, to which, by the present scheme, about $4,500 was returned in rebate from the parent society for the partial financing of the branches.

Proposed amendments to the by-laws of the Institute were discussed at the meeting and, according to the existing by-laws, were passed without change to letter ballot. The most important of the changes include enlargement of the discipline provisions of the by-laws. By an addition to one of the sections it would be in the future required that any member signing a complaint against any member, provided the complaint results in an inquiry into that member's fitness for membership in the Institute, must present himself in person at the inquiry and, failing to give a sufficient excuse for not doing

so, the complaining member himself will be expelled. The second provision of the by-laws raises all of the fees $4 or $5 ($1 for students) so that the highest rate paid under the new provision will be $18 for resident members.

In a general report of conditions it was stated that an arrangement had been made with the American Institute of Mining and Metallurgical Engineers and the American Society of Mechanical Engineers whereby those societies and the Canadian Institute will mutually extend privileges of publications to other members; that is, any member of the American society may obtain the publications at the same rate as the Canadian society member, and vice versa. This action was the result of the efforts of a committee on international relations which is endeavoring to develop ties between the American and the Canadian societies. It was also announced that through some joint action of Canadian societies a uniform boiler code was in a fair way of adoption in all of the Canadian provinces.

Prizes awarded during the current year were as follows: The Leonard prize for 1919 to E. E. Campbell for his paper entitled "Hidden Creek and Its Operation," presented to the Canadian Mining Institute; for 1920 to J. C. Nicol and Staff for the paper entitled "Mining and Smelting Operations of the International Nickel Co. of Canada," also presented to the Canadian Mining Institute. The Plummer prize for 1919 to Dr. A. Stansfield, for his paper before the Engineering Institute, entitled "Electrical Furnaces." The Gzowski prize to R. deL. French for his paper entitled "Design and Construction of Reinforced-Concrete Covered Reservoirs" before the Engineering Institute, and the Student prize to J. R. Dunbar for his paper "Primary Triangulation of the Topographical Survey of Canada" presented to the Engineering Institute.

Registration Laws

Considerable time was given in one of the meetings to a discussion of the proposed registration legislation in Canada. Through the efforts of the Institute some kind of an engineering registration law has now been adopted in each of the Canadian provinces, except Saskatchewan, Prince Edward Island, and Ontario, and in these provinces work is well along toward the successful passage of such legislation. As yet there is little to report as to the operation of these acts except that it was noted that the extra fee required by the Canadian laws for membership in the professional associations (which, as noted in *Engineering News-Record*, Jan. 6. p. 21, are the media through which the registration is made) has a material bearing on the possibility of increased dues in other engineering societies such as the Engineering Institute. No little part of the opposition to increasing dues as required by the by-laws to be submitted to letter ballot was due to this fact.

Another long discussion resulted from the proposal that something should be done to revise the grades in the Institute. There are now students, juniors, associate members, and members, of which the latter two are corporate and have voting powers, and also associates who are not members at all and affiliates who are men, as the word indicates, affiliated only with the local branches. While the discussion as to the necessity for reducing this large number waxed long, it did not have any outstanding unanimity, but the probabilities are that the Council or the committee on policy will make a study of the matter in the ensuing year. The committee on policy, incidentally, reported little more than progress because it has not as yet had time to function actively. It has under consideration, however, a series of recommendations for submission to the Council respecting an appropriate policy for the Institute.

New President of the Engineering Institute of Canada

J. M. R. FAIRBAIRN

Sectional Meetings

The wide attendance on and interest in the sectional professional meetings were particularly significant.

The paper which attracted most attention was entitled "Operation of Toronto Filtration Plant" by James Milne, of the Public Works Department of the City of Toronto. This paper gave the relative costs of construction and operation of the slow sand filters built some years ago at Toronto and the later drifting sand filters installed under the so-called VerMehr patents. The contents of the paper were criticised, particularly by Allen Hazen, of New York City, who was the engineer on the earlier plant. Fuller details of the paper and the discussion will appear later.

The principal officers for the ensuing year elected by ballot were: President, John M. R. Fairbairn, chief engineer of the Canadian Pacific R.R.; vice-presidents, H. G. Acres, hydraulic engineer of the Hydro-Electric Power Commission of Ontario, and Walter J. Francis, consulting engineer, Montreal. The secretary of the Institute is Fraser S. Keith, with offices at 176 Mansfield St., Montreal.

J. M. R. Fairbairn Elected President of Canadian Institute

John Morrice Roger Fairbairn, chief engineer of the Canadian Pacific Railway System, was elected president of the Engineering Institute of Canada at its annual meeting in Toronto Feb. 1-3. Most of his professional experience has related to the railway field.

Mr. Fairbairn was born in Peterborough June 30, 1873. He was graduated from the School of Practical Science in Toronto in 1893 after devoting his summer vacations, while still a student, to practical engineering work, including service under the late W. A. Ramsay, chief engineer of construction for the Canadian Pacific Ry.

His first position was with the Canadian Department of the Interior as principal assistant on topographical surveys in Alberta and later he was transferred to the drafting division of the Department of Railways and Canals. Following a short period with the Department of Railways and Canals as transitman on right-of-way surveys he became engineer in charge of construction of the Lachine and St. Laurent lines of the Montreal Park & Island Ry. In 1897 Mr. Fairbairn became associated, as principal assistant, to Charles A. Stoess on mining claim and land grant surveys in British Columbia, acting also, for a time, as city engineer of Kalso, B. C. He then entered private practice as a civil and mining engineer at Kalso and Greenwood until, in 1900, he joined the construction department of the Canadian Pacific Ry.

In August, 1901, however, he rejoined the Department of Railways and Canals as engineer in charge of Section 3, Simcoe-Balsam Lake Division. He then returned to the Canadian Pacific, in 1901, where he has served continuously in various capacities, starting as principal assistant to the division engineer at Montreal and being promoted steadily until his appointment as chief engineer became effective July 1, 1918.

Mr. Fairbairn has acted as a member of the Council of the Engineering Institute of Canada and as its vice-president.

Northwestern Contractors Annual Convention Announced

A general invitation to contractors has been issued by the Northwestern Association of General Contractors to attend their annual convention in St. Paul March 11 and 12. Convention headquarters will be at the St. Paul Hotel.

Vehicle Tunnel Policies Endorsed by Transport Interests

Recommendations originally made by the engineers of the New York-New Jersey Tunnel Commissions with respect to matters of roadway and traffic, in the vehicular tubes underneath the Hudson River have been concurred in by an advisory transportation committee of twelve members, representing motor vehicle manufacturers and other transportation interests, selected last year by C. M. Holland, chief engineer to the commissions. The report of tnis committee, made public Feb. 7, endorses the two-way roadway, 20 ft. wide, in each tube; the provision for a maximum vehicle width of 8 ft.; a flat (uncrowded) roadway without grooveways; mobile equipment for hauling disabled vehicles out of the tunnel; and the installation of a railroad system of signalling.

The transportation committee has recommended for the vehicular tubes a pavement of close-jointed, cement-grouted granite block. The commissions, however, have not yet reached a decision as to the type of paving.

Condemn "Marshall Plan" for California Irrigation

Sixty-one members of the San Francisco Section of the American Society of Civil Engineers, at a special meeting Feb. 4, passed resolutions condemning the "Marshall plan" for an extensive irrigation system in the central valley of California. The plan, for which R. B. Marshall, formerly chief geographer of the U. S. Geological Survey is sponsor, is receiving support at the state capital in the form of a proposal to appropriate $500,000 for a survey. Propaganda designed to win over the farmer element has been very active.

The civil engineers, at their special meeting, declared the scheme to be physically, legally and financially impracticable, affirming also that the publicity given to the plan has seriously interfered with irrigation and reclamation projects now under way.

A letter, signed by a number of San Francisco engineers and setting forth the case against the Marshall plan, appears on p. 273 of this issue.

Interest Rate on California Road Bonds Raised to 5¼ Per Cent

The California state highway finance board on Jan. 28 authorized the sale of $3,000,000 in highway bonds at 5¼ per cent. This is the first action taken by the newly created board which was formed to adjust the interest rate from time to time to suit conditions of the money market. This first block of bonds is expected to finance the first part of the 1921 construction program. Announcement has been made that bids for paving about 75 mi. of state highway will be received Feb. 21, this work to be financed by the bonds which it is expected can be sold at 5¼-per-cent rate.

Alameda Site for Pacific Naval Base

In a report to the House Committee on Naval Aairs the special joint committee of five members of the Senate and five members of the House, created to investigate the advisability of building a naval base on San Francisco Bay and other matters, reported under date of Jan. 31, favoring the selection of the site at Alameda on the east shore of San Francisco Bay directly opposite San Francisco. This site was selected in preference to the Hunters Point site, in San Francisco proper, and the extension of the Mare Island Navy Yard. The report does not detail any of the deficiencies of Hunters Point, nor many of the advantages of Alameda, but devotes considerable space to demonstrating why Mare Island should not be used. The arguments against Mare Island are mainly, according to the committee's report, the difficulties of future extension, the remoteness (two miles) of the existing shops from the proposed new layout, and the disadvantage of "a location on a shallow and muddy estuary reached by a dredged channel several miles long through Pinole Shoals, making access difficult." The committee admits, however, that the Mare Island development would be much cheaper.

The same report recommends the adoption of the San Pedro (Los Angeles Harbor) site for a submarine base, San Diego for a lighter than air naval aviation base, Port Angeles as an advance operating station for small units, and San Point near Seattle as a heavier than air naval base.

Urge Widening of Lake Washington Canal

At a public meeting held recently at Seattle, Wash., recommendations were made that the Lake Washington ship canal be widened to 300 ft., tapering to 225 ft. at the bottom, with a depth of 30 to 34 ft. at low tide. Recommendations were made to Col. Edward Schultz, U. S. Army engineer in charge of this district. A number of speakers present urged that another canal lock be built, and that it be large enough to accommodate battleships and capital ships of the Pacific fleet. Figures were presented to show the growing use of the canal and locks, and statistics presented were as follows:

In 1916 (four months) 3,230 boats; 1917, 23,392 boats; 1918, 23,250 boats, 1919, 24,700 boats; there is an increase of approximately 25 per cent over the 1919 figures for the year 1920. Testimony indicated that lively industrial and commercial development of the sections bordering on Lakes Washington and Union would follow the widening and deepening of the canal and improvement of facilities at the lock. The Port of Seattle Commission, of which George F. Nicholson is engineer, in a letter to Col. Schultz, went on record as strongly favoring the widening of the canal.

Army Motor Equipment Needed for State Roads, Says Reavis

Another effort to secure motor equipment and other materials from the War Department for use by the states in road building activities has been launched by Representative Reavis of Nebraska. Mr. Reavis declares that the War Department is holding equipment suitable for road-building purposes greatly in excess of its requirements. Much of this material he declares is on the point of becoming useless, due to deterioration. He urges that Congress act while there still is a chance to prevent this equipment from becoming almost a total loss.

His latest bill, which is more comprehensive than the measures introduced previously by the Nebraska Representative, directs the Secretary of War to turn over 1,000 five-ton caterpillar tractors, 500 ten-ton caterpillar tractors and 200 mobile machine shop units. The bill also directs the Secretary of War to turn over shop machinery, machine tools and other equipment suitable for the repair and rebuilding of motor propelled vehicles.

The bill provides that the states are to pay 20 per cent of the estimated value of the property, from which freight and loading charges may be deducted. The valuation is to be made under the direction of the Secretary of Agriculture. The bill provides that none of this material may be sold by the state as long as it is in a serviceable condition.

"Journal of Electricity" Enlarges Its Scope

Enlargement of the editorial scope of the *Journal of Electricity* and a change in its name to *Journal of Electricity and Western Industry* were announced at a dinner given Feb. 1 in San Francisco. The date marked the thirty-fifth anniversary of the *Journal of Electricity*, which has been one of the McGraw-Hill publications since September, 1919. Robert Sibley will continue as editor of the enlarged paper.

The *Journal of Electricity and Western Industry* will be devoted to the upbuilding of the West as an industrial section, and it will interpret Western progress through the application of electric power, light and heat in industries and homes.

House Committee Recommends Atlantic-Gulf Canal Survey

The Committee on Railways and Canals in the House of Representatives on Jan. 27 brought in a report accompanying House Bill 10,919, which requires the Secretary of War to cause to be made a survey "for a canal from Cumberland Sound to the mouth of the Mississippi River." The secretary is instructed in the bill to make a survey and an estimate of cost for a sea-level ship canal, for a lock ship canal, and for a barge canal; $50,000 is authorized for the survey.

To Correlate Standardization in Mining

Recent recommendations of a conference on standardization of mining equipment and practice have resulted in the American Engineering Standards Committee inviting five organizations to designate two members each to represent them upon a general correlating committee, with the understanding that the nucleus so formed might enlarge itself. The correlating committee has been formed with the following membership: American Institute of Mining and Metallurgical Engineers, Graham Bright and Howard N. Evenson; American Mining Congress, Charles A. Mitke and Warren R. Roberts; Mining and Metallurgical Society of America, E. S. Berry and B. Britton Gottsberger; National Safety Council, F. P. Sinn and S. J. Williams; U. S. Bureau of Mines, E. A. Holbrook and O. P. Hood.

The work of the committee will include such matters as: Delimiting specific projects which might be most advantageously handled as units; recommending the order in which the various projects should be taken up in order that the needs of the industry should be served best, and making recommendations as to what bodies should act as sponsors for specific projects, and as to what bodies should be represented.

Michigan Engineers Want State Aid for Colleges

More than 200 engineers attended the three-day convention, Jan. 25, 26 and 27, of the Michigan Engineering Society, State Assembly of A. A. E., at Detroit.

Endorsement was given of the budgets of the University of Michigan, Michigan Agricultural College and the Michigan College of Mines. In the resolution were clauses commending higher education as a state benefit and therefore calling through proper compensation for the most able and competent instructors. The St. Lawrence-Great Lakes deep waterway project was endorsed and further detailed study by a board of "competent highly qualified engineers" called for. Salary schedules of the A. A. E. were adopted for engineers in state railroad highway, municipal, country and state service.

A special committee was appointed to assist in enforcing the engineers' license law. It was recommended that the list of registered engineers be sent to all state, country and municipal officials, since they have already been asking where engineers so qualified might be obtained.

The Governor has proposed the creation of a state department of public works and the committee was named to get in touch with the Governor and investigate the proposals. Recommended revision of the state's drainage laws are to be brought in by a committee at the next meeting.

New York Office Opened to Aid Trade in Germany

In the interests of American manufacturers, exporters and importers, and for the purpose of giving information on all matters pertaining to commercial intercourse between the United States and Central Europe, the American Chamber of Commerce in Berlin has established an office in the Park Row Building, New York City, in charge of S. George Fremont, secretary and manager.

Structural Section Formed by Boston A. A. E. Men

A structural section of the Boston chapter of the American Association of Engineers was formed at a meeting held Jan. 7. Prof. E. H. Rockwell, Tufts Engineering School, was elected president; Paul B. Covey, New England Structural Co., vice-president; R. B. Johnson, Harvard Engineering School, secretary-treasurer.

Edison Company Lays Out Big Power Development Program

The railroad commission of California on Jan. 21 authorized the Southern California Edison Co. of Los Angeles to proceed with a construction program that is to call for the expenditure of approximately $48,000,000 in the next six years. The work contemplated includes the construction of reservoirs, conduits and power plants on the San Joaquin River and its tributary, Big Creek, in Fresno County. The additions made to the power company's system under this program are to increase its capacity by 360,000 kw. and add to the annual output 1,500,000,000 kw.-hr.

In authorizing this development the commission says, "It appears that the demands for electricity in the territory now supplied by applicant are constantly increasing and must be met largely by the construction of new hydroelectric plants. The funds to be used in this work are to be obtained from the sale of applicant's stocks and bonds."

The principal items of construction included in the program which has been thus approved are (1) Florence Lake reservoir at the head waters of the San Joaquin, capacity 43,000 acre-feet, (2) tunnel 11 mi. long, connecting Lake Florence with Huntington Lake, (3) conduits from Huntington Lake to Shaver Lake, (4) a new hydroelectric generating station above Shaver Lake to be known as power house 1-A, (5) a reservoir at Shaver Lake, capacity 138,000 acre-feet, (6) conduits from Shaver Lake reservoir to a generating station to be known as power house No. 2-A, (7) a new hydroelectric generating station to be known as power house 2-A on Big Creek, (8) a third generating unit to be installed in the present power house No. 1 on Big Creek, (9) enlargement of hydroelectric generating station known as power house No. 8.

Fifteen Millions for Rivers and Harbors

A lump-sum River and Harbor bill carrying $15,250,000 has been reported to the House of Representatives. Of that sum, $15,000,000 is to be allotted to the Chief of Engineers for maintenance. The remainder, $250,000, is to be expended for surveys and contingencies. The bill, as reported, is a decided reduction from the $57,000,000 requested by the Chief of Engineers. A minority report was made which includes a substitute bill carrying a total of $28,271,850.

The majority of the Committee on Rivers and Harbors contends that the $15,000,0000 plus the $47,000,000 of river and harbor funds from previous appropriations, which have not been expended, should be enough to carry the work to June 30, 1922. The minority claims that the $47,000,000 on hand is credited to certain projects and can not be applied where the new appropriation is needed. The minority takes the position that Congress is delegating its responsibility to the Chief of Engineers when it fails to bring in an itemized bill. The majority contends that the lump-sum bill makes available all the money needed to take care of the work urgently needed.

Nova Scotia Highways Investigated

Charges of irregularity in the administration of the Nova Scotia Highway Act are being investigated by a committee consisting of two judges and F. W. W. Doane, city engineer of Halifax. The opening and alteration of tenders after the hour for closing had passed are among the alleged acts which have started the controversy. Certain changes in personnel have accompanied the investigation, among them the appointment of W. A. Hendry of Bedford as chief engineer to succeed John Roland.

Will Not Consider Use of More Flow of Niagara

No applications under the Water-power Act involving the prospecting use of water from the Niagara River, under an amended treaty with Great Britain, will be considered by the Federal Power Commission. This announcement was made by the commission during the course of its hearings held in Washington Jan. 24, 25 and 26. Even discussion of the problems involved, should additional diversion be authorized, was ruled out, but the commission made it clear that it would give consideration to possibilities under additional diversion in considering proposals for the use of existing water.

The city of Buffalo is the only applicant contesting the claim of the Niagara Falls Power Company. Representatives of the city of Buffalo were accorded much time at the hearing, but it was evident that the commission was

not impressed with all their arguments. Among other things it came to the attention of the commission that the commissioners of Buffalo are divided on the water-power policy to be pursued.

Brick Makers Discuss Building Costs

Discussions of the broader problems affecting the industry, as well as those having to do with methods of increasing the production and consumption of brick, were given prominent place on the program of the joint session of the National Brick Manufacturers' Association and the Common Brick Manufacturers' Association, whose annual meetings were held in the Hotel Pennsylvania, New York City, Jan. 31-Feb. 4.

Though the greater part of the convention time was consumed in discussion of more or less technical methods of brick manufacture, handling and transportation, action was taken through resolution on several important issues which concern employment relations and the broad administration of the industry. Chief among the resolutions were those (1) Recommending co-operation with architects and others in stimulating enrollment of apprentices in the brick-laying trade; and (2) urging upon Congress the adoption of custom duties that will result in a reciprocal agreement for the shipment of brick between the United States and Canada.

Tariff duties from the United States to Canada now are 30 per cent ad valorem, with an anti-dumping clause. To the United States from Canada, brick is taxed 10 per cent ad valorem, an anti-dumping clause also being included in the tariff provision. The National Brick Manufacturers' Association recommended all duties on brick be removed and that there be no anti-dumping clause, or at least that the duties not exceed 10 per cent ad valorem.

It was stated from the floor of the convention that approximately 90 per cent of the plant capacity of the Common Brick Manufacturers was now idle. When a resumption in brick manufacture will occur, depended, it was said, upon a lowering in wage cost. One statement was made that a recession of 25 per cent in the common labor wages would probably result in a drop of from $1 to $2 per thousand in the price of brick. Despite the present condition of the industry, it was frequently stated that a resumption in building construction was bound to come, though it would not come perhaps until several months after normal spring construction begins.

The belief was generally expressed that during the coming year or so brick will have its greatest market in building house construction. Therefore, in order to make a brick house competitive in first cost with any other type, a new type of wall has been developed, called the "ideal" wall. It is a hollow wall, having several forms, the simplest being the laying of the brick so that every other brick in every course is a header. Tests are now being carried on to determine if that type of wall will meet city building code requirements. Once its status as an approved design is secured, a large increase in the consumption of brick is looked forward to.

Contracts Awarded in January 1920 and 1921 Compared

Contracts actually awarded in January, 1921, as reported in the construction news section of *Engineering News-Record* have a money value of more than $54,000,000. The total for the same month of 1920 was approximately $175,000,000. Most of the difference between these two figures is accountable in the decline in industrial building, in the construction of office, bank, school, loft and business buildings, and in miscellaneous construction. The amount of money involved in waterworks, sewer, bridges, street and road, railway, and excavation and dredging contracts actually awarded in January, 1921, compares favorably with the aggregate value of contracts of the same classification let in the corresponding month of 1920. In January of this year the money value of industrial works contracts was but approximately $13,000,000 and that of buildings but $17,500,000; whereas in January, 1920, contracts to the extent of $56,000,000 were awarded for industrial buildings and $87,000,000 for building construction.

A comparison of the money valuation of the various classifications for the corresponding months of 1920 and 1921 are given herewith:

Classification	Jan., 1920	Jan., 1921
Waterworks	$1,143,777	$519,028
Sewers	1,863,840	3,146,948
Bridges	2,021,553	3,030,477
Streets and roads	12,203,970	11,597,810
Railways	15,000	80,000
Excavation dredging	1,541,576	1,266,349
Industrial works	56,041,047	12,881,968
Buildings	87,095,987	17,455,673
Federal government	4,980,945	2,071,141
Miscellaneous	8,256,071	2,358,976
Totals	$175,163,766	$54,408,367

Brindell Is Found Guilty

Robert P. Brindell, president of the New York Building Trades Council, whose trial on charges of extortion has been going on before Justice McAvoy in the New York Supreme Court for the past several weeks, and whose indictment resulted from the investigations made by the Lockwood joint legislative committee on housing, was found guilty Feb. 3. The jury reached a verdict on the first ballot. The offense of which he is convicted carries with it a maximum penalty of fifteen years' imprisonment, there being no alternative of a fine. This is the first conviction growing out of the investigations made by the Lockwood committee.

Brindell's attorney was given time in which to file a motion for an appeal.

Trial of Hettrick, Code of Practice Author, Begins

The trial of John T. Hettrick, of "code-of-practice" fame, whose indictment was returned by a New York grand jury growing out of an investigation made by the Lockwood joint legislative committee on housing, began Feb. 8 before Justice McAvoy of the Supreme Court. The charge against Hettrick is that of coercion. The case is based on allegations that Hettrick with certain labor co-defendants, coerced firms and individuals to join the code-of-practice to restrain competition. Prosecution of the case is in the hands of Henry L. Stimson, former Secretary of War.

Toledo Creates Emergency Unemployment Fund

In order to care for the unemployed the city of Toledo recently passed an emergency measure calling for the appropriation of $25,000 with which to repair streets, alleys and public buildings. A number of the city's former unemployed are already at work.

Thirty Per Cent of Eighty-four Chicago Unions Idle

A recent announcement made at a meeting of the Chicago Federation of Labor was to the effect that in 84 unions but two-thirds of the members were employed. The largest percentage of unemployed is in the building industry. There are approximately 200,000 union workers in the 300 unions in Chicago.

Nation-Wide Move to Scale Down Railroad Wages

Through its decision in the application of the Atlanta, Birmingham & Atlantic Ry. for authority to reduce wages the United States Railway Labor Board, meeting in Chicago Jan. 27, opened the way, in the opinion of many railroad executives, for a nation-wide readjustment and scaling down of railroad wages. Following the decision meetings of the labor committee of the Association of Railroad Executives have been held at which agreement is reported that operating expenses must be reduced a half billion a year, since it is not considered feasible to raise rates above the present level. It is also indicated that some $150,000,000 per year can be eliminated by abrogation of national shop agreements of which the Association of Railway Executives may ask annulment.

The Railway Labor Board decided that the Atlanta, Birmingham & Atlantic Ry. had no status before the board inasmuch as it had failed, first, to negotiate with its employees before appearing before the board. It is considered that the decision opens the way for individual negotiation by the carriers with their employees for such revision downward as is considered consistent with the present trend of readjustment.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF ENGINEERS, Chicago; Seventh Convention, Buffalo, N. Y., May 9, 10 and 11.

AMERICAN CONCRETE INSTITUTE, Detroit; Convention, Chicago, Feb. 14-16.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; Annual Convention, Houston, Texas, April 27.

AMERICAN ROAD BUILDERS' ASSOCIATION, New York City; Convention, Chicago, Feb. 9-12.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York; Spring meeting, Chicago, May 23-26.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, Chicago; Convention, March 15-17.

The New Jersey Sewage Works Association at its annual meeting, Feb. 18, will be addressed by the following speakers: Weston Gavett, "Sewage Siphons"; Thomas J. Headlee, "Certain Phases of the Biology of Sewage Disposal"; John R. Downes, "Practical Operating Data on Imhooff Tanks and Screens"; C. M. Nichols, "The Design and Operation of Single-Story Tanks." There will be an open discussion on assessment methods for new sewers.

The American Wood Preservers Association held its annual meeting in San Francisco, Jan. 25-27. More than a score of committee reports and papers had been printed in advance for distribution and most of these were read in abstract in order to afford as much time as possible for discussion. There were joint dinner-meetings with the San Francisco Section Am. Soc. C. E. and with the National Association of Railroad Tie Producers. Officers elected for the ensuing year were president, C. M. Taylor, superintendent of treating plant, Philadelphia & Reading railroad and Central Railroad of New Jersey; vice-president, F. J. Angier, superintendent timber preservation, Baltimore & Ohio railroad; secretary-treasurer, G. M. Hunt, chemist, forest products laboratory, Madison, Wis. The next annual meeting will be held in Chicago in January, 1922.

The National Association of Railroad Tie Producers held its annual meeting in San Francisco, Jan. 27-28. In accord with the usual custom reports from regional representatives were received and a limited number of papers relating to the tie producing industry were presented. Officers elected for the ensuing year were: president, Charles R. McCormick, Charles R. McCormick & Co., San Francisco; vice-president, J. H. Johnson, B. Johnson & Son, Richmond, Ind.; secretary, Warren C. Nixon, Western Tie & Timber Co., St. Louis; Treasurer, J. J. Schlafly, Potosi Tie & Timber Co., St. Louis. The 1922 convention is to be held at Chicago, Ill.

The Indiana Sanitary and Water Supply Association will hold its fourteenth annual meeting at the Claypool Hotel, Indianapolis, Ind., Feb. 16-17.

The American Water Works Association, New York Section, at its meeting Feb. 16, will be shown moving pictures of trenching machines manufactured by several companies and their representatives will answer questions after describing the machines. How to cut labor costs on pipe laying work will be discussed at this meeting.

PERSONAL NOTES

T. CHALKLEY HATTON, chief engineer, Sewerage Commission, Milwaukee, Wis., has left for Europe where he will spend two months in the study of municipal sewage disposal plants in France, England, Germany and Italy. He will also gather data on the operation of the Schaefer-ter-Meer sludge de-watering machine.

E. C. MACY has gone to Japan in the interests of Stone & Webster, New York, to take charge of the design and construction of a hydro-electric development on the Sho River for the Shogawa Hydro-Electric Co. He was recently in charge of the construction of the Caribou hydro-electric development for the Great Western Power Co. on the Feather River in California.

THORNTON A. MILLS has resigned the position of designer with the Madera Irrigation District of California to go to the Philippines as civil engineer, department of public works, at Manila, P. I.

JOSEPH C. LETTS, former Captain of Engineers, U. S. A., has been appointed a construction engineer in the U. S. Public Health Service, with headquarters at Waukesha, Wis.

HARRY THOURAT, formerly employed in the county engineer's office, Trenton, N. J., has been appointed town engineer of Union Hill, N. J.

D. FAIRCHILD has been appointed acting supervisor, bridges and buildings, Puget Sound division, Northern Pacific Ry., with headquarters at Seattle, Wash., to succeed W. E. Bradley, who is on a leave of absence.

S. H. INGBERG has been transferred from Chicago to Washington, D. C., to take charge of the investigations on fire resisting properties of building materials conducted by the U. S. Bureau of Standards.

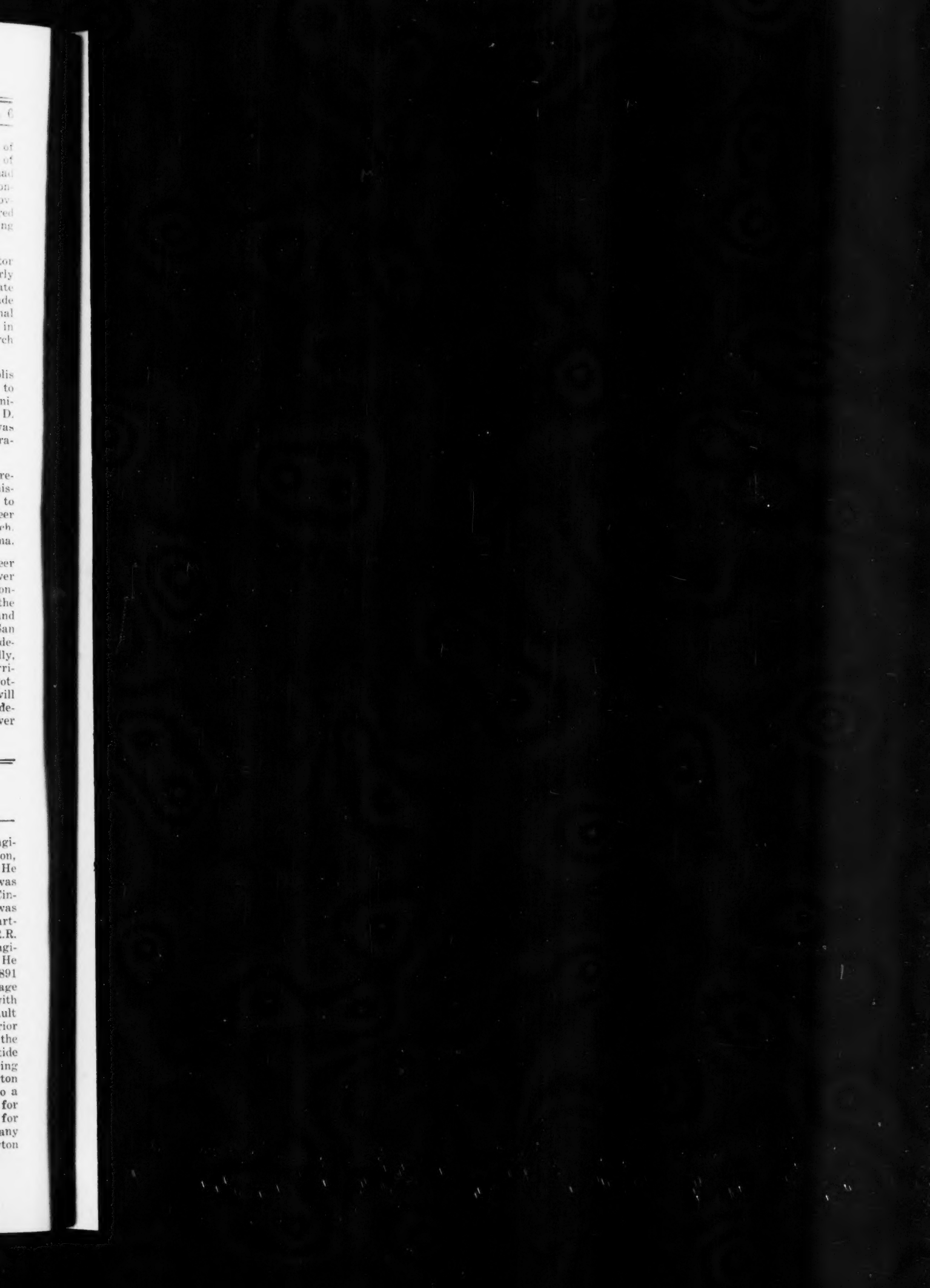
COLONEL A. EARCHMAN of Kemptville, Ont., engineer-in-chief of Ottawa-Prescott highway work, has had the Order of the British Empire conferred upon him by the Imperial Government for notable service rendered during the World War as commanding officer of a railway battalion.

DUDLEY F. HOLTMAN, associate editor *American Contractor*, and formerly senior structural engineer, Interstate Commerce Commission, has been made construction engineer of the National Lumber Manufacturers Association in charge of the technical and research department.

C. K. CALVERT, chemist, Indianapolis Water Co., since 1908, has resigned to become the chief chemist for the Sanitary Board of Indianapolis. N. D. Doane, who succeeds Mr. Calvert, was formerly at the South Pittsburgh filtration plant.

FREDERICK STUART GREENE, who resigned as New York State Commissioner of Highways Feb. 1, plans to open an office as consulting engineer and to begin active practice in March upon his return from a trip to Panama.

R. C. STARR, construction engineer with the San Joaquin Light & Power Corporation, and F. M. Thebo, construction engineer, have organized the firm of Thebo & Starr, engineers and contractors, Sharon Building, San Francisco. They will undertake design and construction work generally, specializing on hydro-electric and irrigation projects. In addition to devoting time to the new firm Mr. Starr will retain his position in charge of design and construction with the Power Company.

OBITUARY

COL. HARRY E. TALBOTT, engineer and manufacturer of Dayton, Ohio, died Jan. 31 at Miami, Fla. He was born in Cincinnati in 1860 and was graduated from the University of Cincinnati in 1880. Early in life he was connected with the engineering department of the Cincinnati Northern R.R. In 1883 he was appointed division engineer of the Northern Pacific Ry. He gave up railroad engineering in 1891 and went to Dayton in 1892 to engage in contracting. Among the works with which he was connected were the Sault Ste. Marie dam, the Lake Superior Paper Co.'s plant at the Soo and the water-power plant of the Laurentide Pulp & Paper Co. at Quebec. During the World War he organized the Dayton Metal Products Co. and entered into a contract with J. P. Morgan & Co. for the purpose of manufacturing fuses for high explosive shells. This company also took over and financed the Dayton Wright Airplane Co.